THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXII. No. 1589.] LONDON, OCTOBER 24, 1893. [45TH YEAR. PRICE 6d.

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See Advt. p. III., centre of JOURNAL

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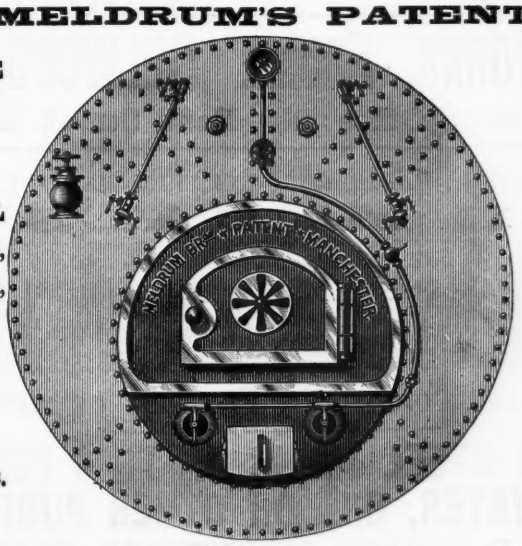

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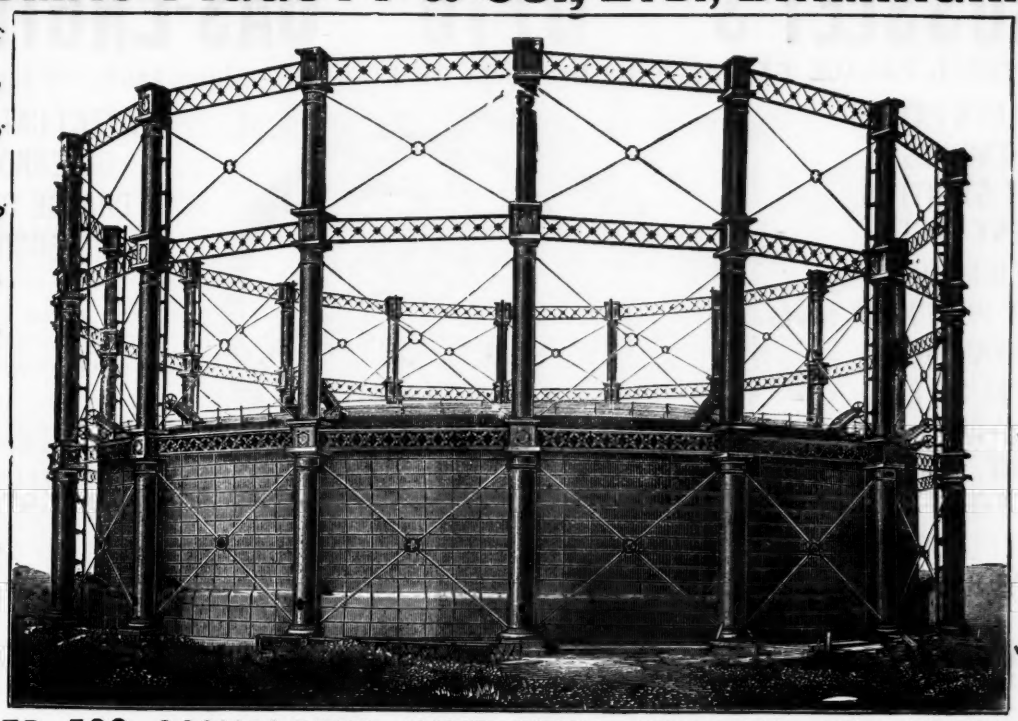

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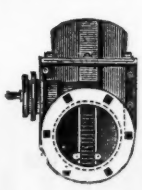

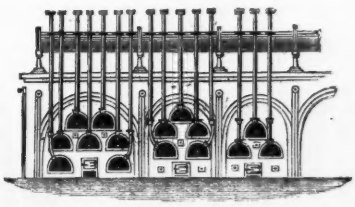

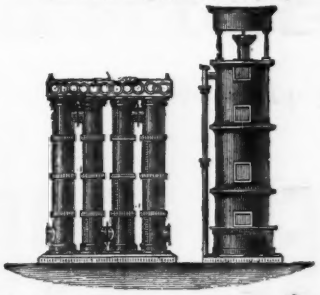

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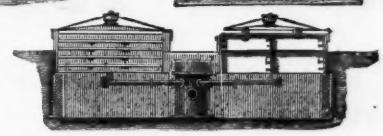

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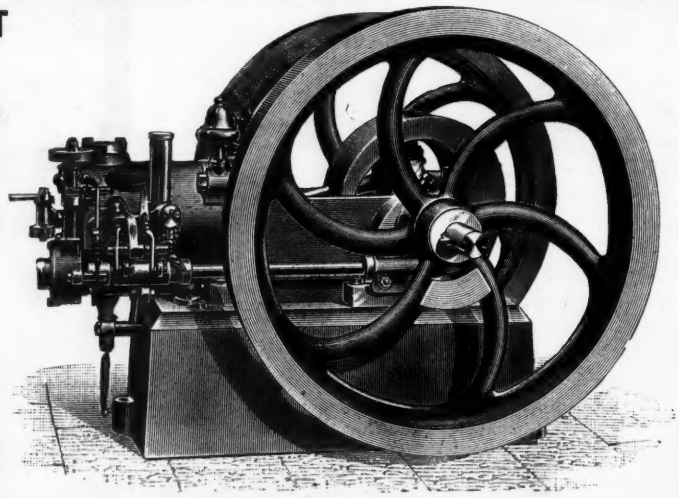

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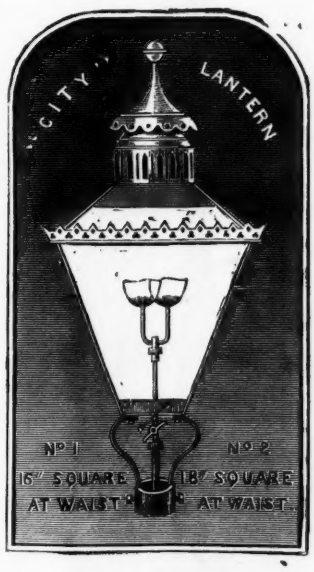

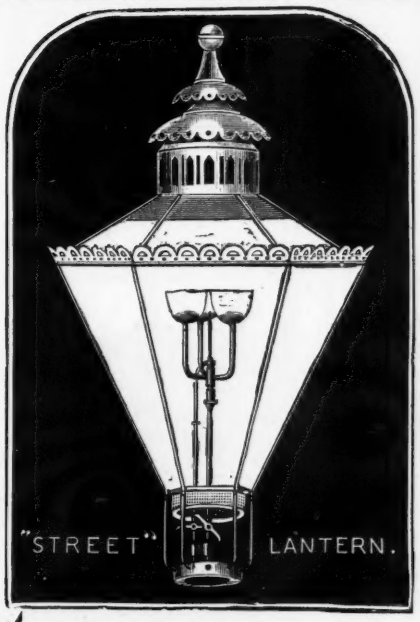

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Are the best in the Market for general use, and are very moderate in price.

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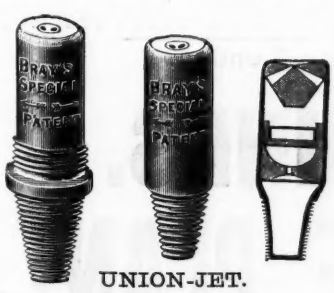

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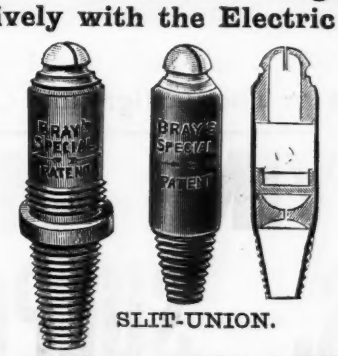
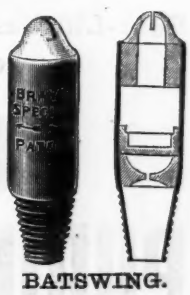


SLIT-UNION.



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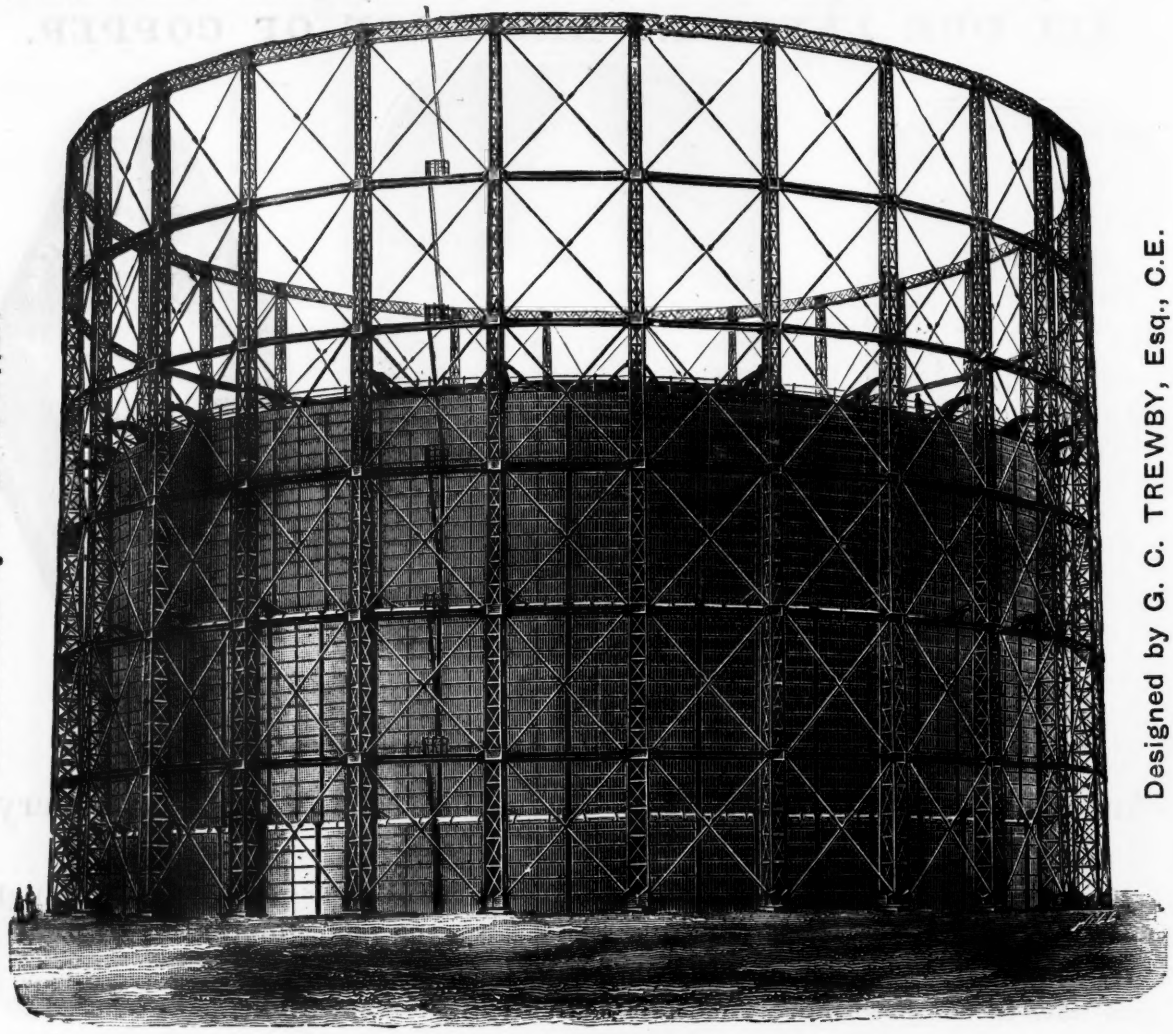

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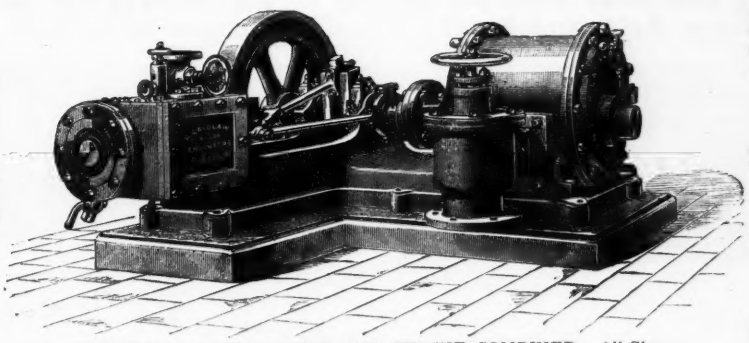

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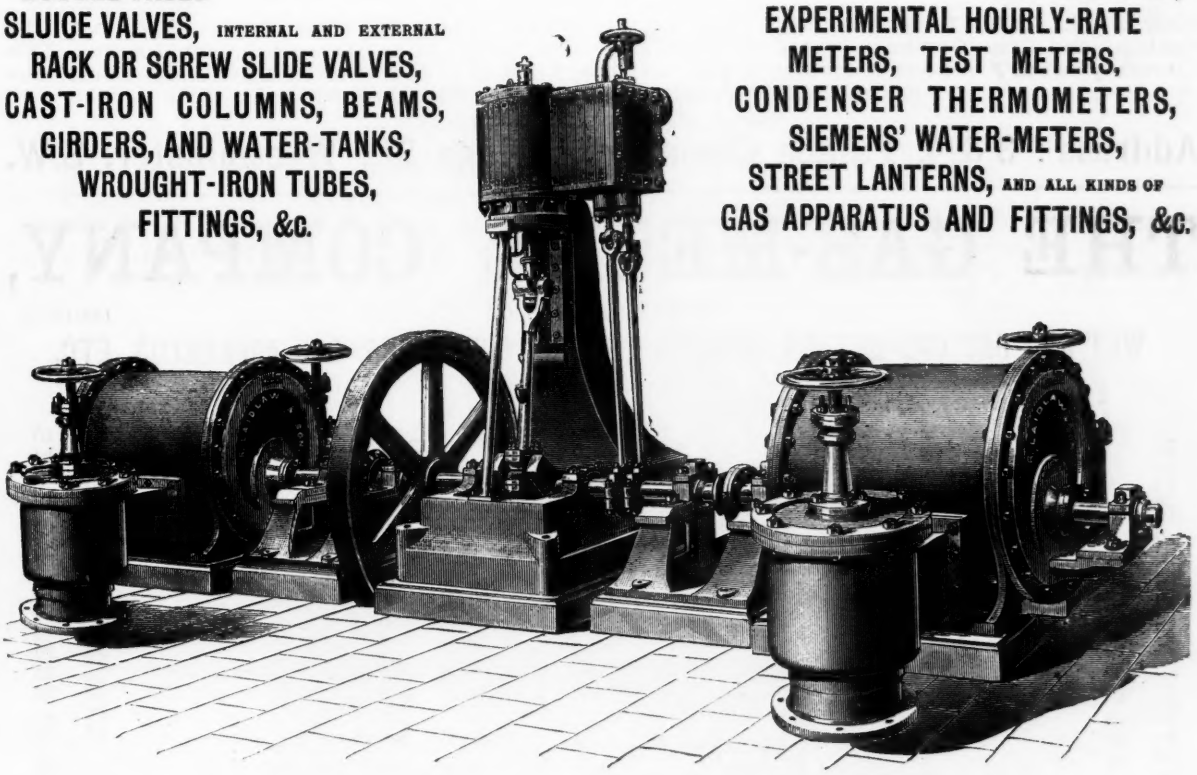

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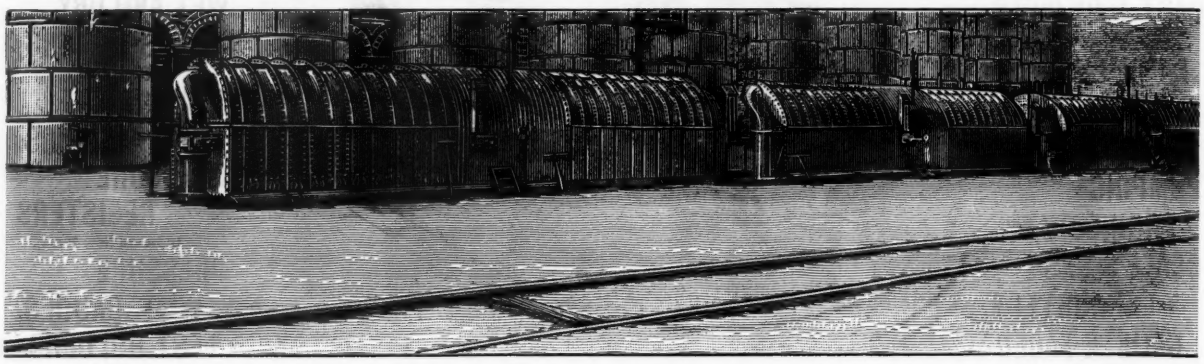

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GASHOLDER TANKS; *and* EVERY REQUISITE *for* GAS *and* WATER WORKS,
INCLUDING
MAIN LAYING
EXCHANGE TELEPHONE 1756.

L. W. LEEDS' PATENT
FLOOR-WARMING GAS-STOVES.

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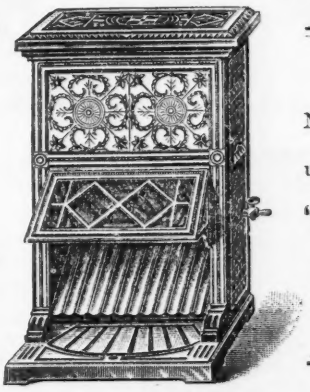

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NEARLY
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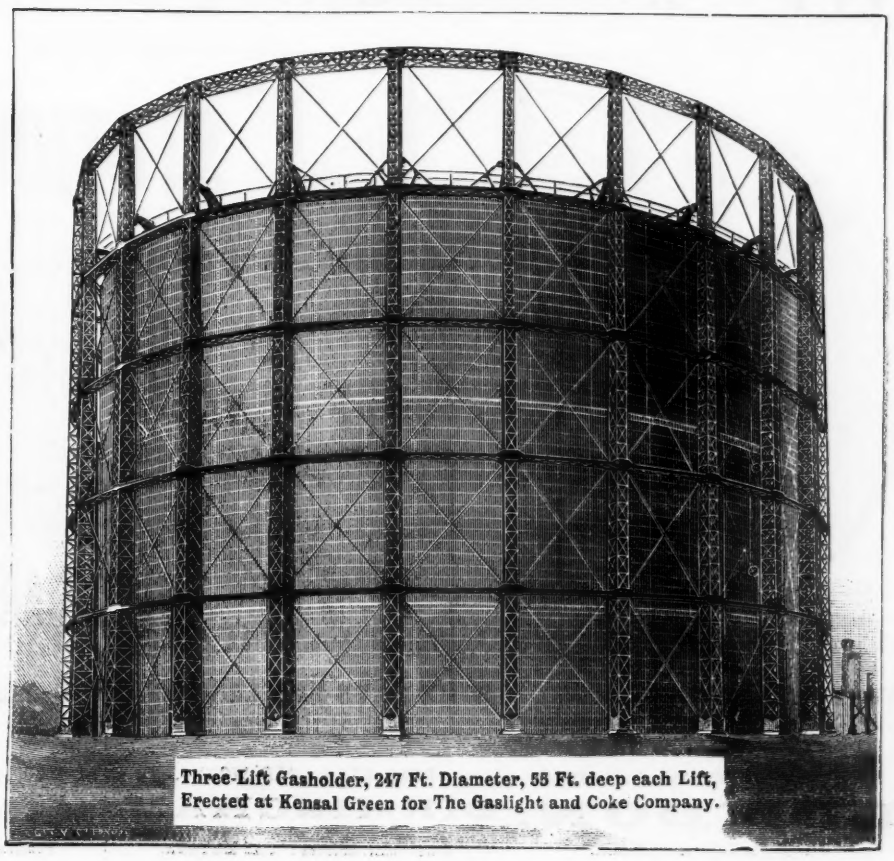
CUBIC FEET
CAPACITY.



Three-Lift Gasholder, 247 Ft. Diameter, 55 Ft. deep each Lift, Erected at Kensal Green for The Gaslight and Coke Company.

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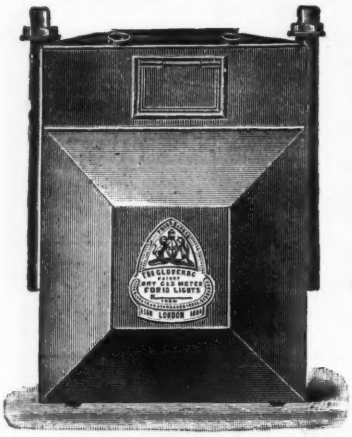

1st.—Are a remedy for all the defects of Wet Meters.
2nd.—Are suitable for all Climates, whether hot or cold.
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6th.—Prevent jumping or unexpected extinction of the Lights.
7th.—May be fixed either above or below the level of the Lights.
8th.—Cannot be tampered with without visibly damaging the outer case.
9th.—Will last much longer than Wet Meters.
10th.—Will not cost more than one-half for repair that Wet or Water Meters do.

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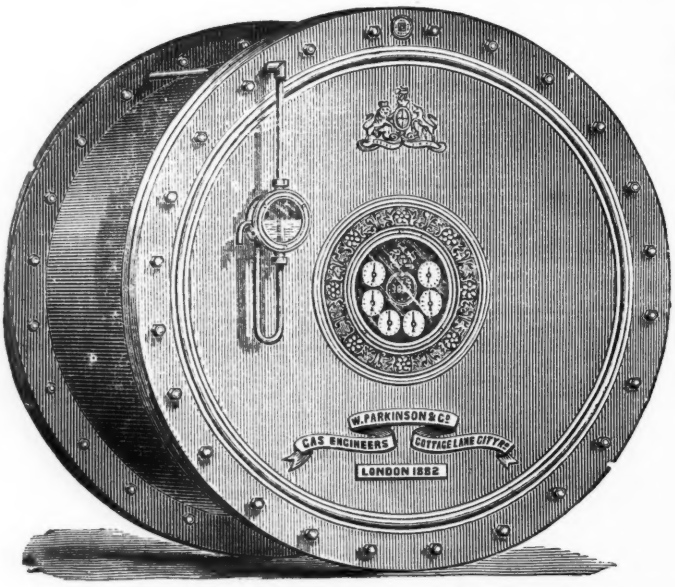

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IN

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500 STATION METERS,

Varying in size from **1200** to **250,000** cubic feet per hour, have been sold, fitted with

THREE-PARTITION DRUMS.

DURABILITY UNEQUALLED. SOME HAVE BEEN IN CONSTANT USE FOR OVER 60 YEARS.

COTTAGE LANE WORKS, CITY ROAD, **LONDON.** Telegraphic Address: "INDEX."

BELL BARN ROAD WORKS, **BIRMINGHAM.** Telegraphic Address: "GAS-METERS."

10, MAWSON'S CHAMBERS, DEANSGATE, **MANCHESTER.** Telegraphic Address: "PRECISION."

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TO CORRESPONDENTS.

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THE
JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, OCTOBER 24, 1893.

The Progress of the Coal War.

THE recurrence of the locked-out miners to outrage, rioting, and violence last week does not look well, even from the point of view of the strike leaders. It only shows once more that if the protection of the strong arm of the law were withdrawn from the disturbed districts, the collieries would be effectually prevented from ever resuming work at any rate of wages, so blind is the mob when permitted to have its own way. This outbreak of lawlessness is particularly unfortunate for the Miners' Federation; inasmuch as before it happened public sympathy was veering round to the side of the men, attracted by their really magnificent doggedness in standing out for their own terms. The British public admires pluck, and sympathizes with suffering; and the two have been exhibited in such striking combination throughout the Federation districts during the past two months, that if the men had remained quiet their funds would most certainly have benefited by a rising flood of subscriptions. The British public hates rioting, however; and no cause that ever fell into this way of asserting itself has prospered within these realms. It is all very well to say that the colliers have been driven by their sufferings beyond the limits of human endurance, and that the colliery proprietors, by their "inhuman" conduct, have incited the men to break the peace. Such a plea is good enough for a mass-meeting speech; but it will not hold good with people who remember how the same sort of apology was offered for the mobs that earlier in the century resisted the introduction of every kind of labour-saving machinery. Last week the colliery proprietors appeared to be giving way in every direction; but the Wigan riots serve to emphasize the fact that the number of men who have returned to work are a minority, and that the outstanding employers are as rigid on the point of policy as ever. Meanwhile, the coal-fields that are able to go on working are doing wonders. After its recent fit of fever, South Wales has returned to sanity; and a special correspondent of a contemporary reports how, having recently had a run through the principal part of the colliery region, he was "impressed with the fact "that the colliers have brushed agitators and agitation "on one side, and have settled down to make the best of "the golden opportunity now before them." The result is that "at no period since the seventies has there been "such an immense coal traffic" as there is now going on in Welsh coal of all kinds. It is a great pity that this kind of information does not get into the daily papers, which inflate themselves over a squabble or a strike, and forget all about the district when matters are taking their ordinary course. It would be impossible to say how much damage is done by neglect to publish sequels to the sensational accounts of industrial and other escapades which attract public attention for a time, and then drop out of notice. This scrambling way of writing the history of our own times plays the game of the agitators, who have no reason to fear being connected with ever so disastrous a failure in the shape of a strike, or even an unhappy lawsuit. All they have to do is to discreetly leave the neighbourhood; and, so long as they remain out of reach of the fists and brickbats of their old dupes, they need not dread newspaper reminders of their blunders. Mr. Richard Swiveller was accustomed, as everybody knows, to keep memoranda of the streets which it was inexpedient for him to traverse by reason of his unliquidated indebtedness to the shopkeepers. How many places, we wonder, are similarly struck out of the visiting lists of our most notorious labour leaders? Manchester, Cardiff, Southampton, Hull—these and many more are "words of fear" to certain strike organizers, who would not for a trifle be found in the places indicated. These are considerations which never occur to the perfervid writers in newspapers like the *Daily Chronicle*. It is certain, nevertheless, that the very livelihood of a large number of Trade Union officials is at stake upon the issue of the present dispute in the coal trade. The loyalty of the men is sorely strained as it is by the premature exhaustion of the Union funds, which have generally proved insufficient to return more than a small fraction of the amount of the subscribers' contributions; and if the Federation should be beaten after all, the very first thing the deceived colliers will do will be to make a general clearance of their leaders all round.

The Association of Sulphate of Ammonia Manufacturers.

THE annual general meeting of the Association of Sulphate of Ammonia Manufacturers is like all the other proceedings of this and kindred organizations in not being meant to court the public eye. The Association is not at all a mysterious body, however; and the names of the gentlemen connected with it are a sufficient guarantee that there would be nothing to blush over if their transactions were to be placed in the full glare of publicity. The Association is purely a trade organization intended to watch over the interests of manufacturers of sulphate of ammonia; and as we took a lively interest in its formation, so we are pleased to learn that it is prospering and

duly justifying its existence in the estimation of those who are best qualified to judge. So quietly has the Association been doing its work, that outsiders have had few opportunities for ascertaining whether it was still living. This must be the reason why it is not better supported. Mr. J. Hepworth, of Carlisle, who presided over the last general meeting, stated that the membership of the Association now numbers 84, "all makers of good "standing;" and he expressed the hope of the Council that "means may be found to bring the remainder to "see that such an Association as this is one to be "supported." We most gladly commend this invitation to the attention of makers who do not already belong to the organization, especially where abstention has mainly been due to the mistaken notion that it is not worth while for small makers to join it. As a matter of fact, it is precisely the small manufacturers who derive the greatest good from such a means of union with their fellows. Large concerns are able to take care of themselves, and have at their command plenty of resources to help them in carrying on a profitable trade. Consequently, the "sharks" of the chemical trade—and in no department of commerce are this class of dealers more acute or daring—carefully leave the big factories alone, and seek their victims among the smaller fry. Moreover, the small makers have the very best opportunity for creating and carrying on a local sale of their product; and the Association devotes particular attention to this branch of the trade—selecting and disseminating the sulphate literature best calculated to instruct the agricultural community in the use of this form of nitrogenous fertilizer. Yet a stronger reason for the entry of small makers into the Association is to be found in the history of the well-known Sunderland still case. Here the Excise authorities elected to try conclusions with a comparatively small undertaking as to whether a precedent for taxing all the sulphate stills in the kingdom could not be established. It was a deliberate attempt on the part of the Inland Revenue authorities to bully a weak manufacturer into submission to their outrageous demand and irritating interference; for, not content with laying an information before the local Magistrates, and getting it dismissed, the excisemen appealed to the High Court of Justice—only, however, to lose again. If the Association had not come to the rescue on this occasion, the Sunderland Gas Company might, and probably would, have yielded the point, and consented to pay the tax rather than incur the cost of fighting. As it was, the Association was successful in protecting the industry from the attempted extortion and interference; but only at a cost of something between £200 and £300. Well might Mr. Hepworth, in telling the tale, remark upon the astonishment felt by the Council at the bill of costs for defending what seemed to be such a simple case. This statement raises the further question of how and why the judicature system of the country has fallen into discredit; but we cannot discuss this subject now. At all events, the incident is most instructive upon the point of the benefit to small makers of having such an Association as this at their back.

Lord Kelvin on State Socialism.

Lord Kelvin was present last week at the inauguration of an extended and modernized municipal electric lighting plant for Blackpool, which has taken the place of the original Siemens plant laid down in 1880. A good deal was said by his scientific Lordship and other speakers on this auspicious occasion about the success of the old plant; but we have not noticed any reference to the fact that it was the practical experience in lighting work of Mr. J. Chew, the Blackpool Gas Manager, and of his son, Mr. W. Chew, which was mainly instrumental in preserving this experiment from resulting in such a failure as attended most of the pioneer electric lighting enterprise of the period. This by the way. Lord Kelvin had a good deal to say on the subject of the extension of municipal responsibilities to include services hitherto usually performed by private initiative. He declared that municipal authorities are quite right in taking into their hands "everything that is "for the good of the borough, without, of course, entering "on transactions in distant places." His Lordship went on to name electric telegraphs and telephones as matters beyond the scope of municipal enterprise. This latter statement was, of course, intended for the Glasgow people; but the expression of opinion that preceded it is wide enough, in all conscience. Lord Kelvin defended himself from the reproach of advancing too far in the direction of State Socialism; but he went so far as to approve of the taking over of the railways by Government. He admitted that this is a great question, and observed that it is for statesmen to consider it. We should like to hear further from Lord Kelvin upon this interesting subject, to see how he would make out his case upon the ground of expediency, and where he would draw the line. It is quite true, as he said, that "the private interests of a "company might easily interfere with the general interests "of the community; and it is well to prevent that state "of things arising." As a matter of fact, the private interests of companies, including those of railway companies, do very frequently and most annoyingly clash with the interests of the community. Those who are best acquainted with the working of companies best know the shortcomings of the system; but it by no means follows that universal nationalization or municipalization would be a cure for all defects of this kind. Taking the discussion upon the very highest ground, it may be easily demonstrated that where private initiative has had the greatest vogue, there the public interest has benefited most. Again, where is the line to be drawn? The most remarkable development of State interference in industrial concerns that has yet come under our notice is, curiously enough, of American origin. It appeared in the form of a report constituting an appendix to the Official Gazette of the United States Patent Office, concerning an application by the State of South Carolina for a trade mark, to be used as a brand for certain alcoholic beverages prepared in the State laboratories! The application was unsuccessful; but, preposterous as the idea of a sovereign State engaging in such a trade appears at a first glance, it is easily explained as being only one step following many. In the first place, the people of the State were found to be suffering from the unscrupulous action of vendors of impure drugs. What easier or more natural than the establishment of a State-controlled dispensary of pure medicines? From selling drugs to preparing them is hardly a step; and from drugs to beverages is a simple transition. This good illustration of the possibilities of "Progress" is worth remembering.

Mr. Asquith's Programme.

The Home Secretary, Mr. Asquith, has been addressing his constituents in East Fife upon certain topics arising out of the working of his own Department; and he took the opportunity of saying something of the intentions of the Government with regard to factory and workshop legislation. The antagonism between the railway servants and the Government in respect of the Bill to amend the law of employers' liability is as definite as ever; and it would not be surprising if the Administration were to be reminded of this fact very unpleasantly when the measure is proceeded with in the approaching autumn session of Parliament. The Government Bill has been applauded by various and sundry Trades Unions with high-sounding names, which claim to represent the railway and other industries of the country; but it would puzzle an earnest democrat who sincerely believes in the right of majorities to rule, to say why this principle should not apply to the case of the employees in great railway and other undertakings who notoriously outnumber the trades unionists. Mr. Asquith has had to defend himself from reckless charges by persons like Mr. Cuninghame Graham, of having employed force unnecessarily in the suppression of the dangerous rioting that has unhappily attended the great coal strike; but he has easily acquitted himself in this task. With regard to further legislation on industry, it is satisfactory to learn that the Home Secretary has scarcely anything to propose. He apparently believes in strict workshop inspection, and especially in inspection by working-class specialists; and he is satisfied that much good may be done in this way. Finally, with regard to the conduct of what are called "dangerous trades," the Home Secretary seems to hold sound and sensible views. He has remarked that it is impossible to read the accounts which from time to time appear in the newspapers of accidents and inquests, without becoming aware of the fact that in a number of industries in this country the workers are exposed to daily risks to health and limb which might be, and ought to be, prevented; but he also admits that "it is a very difficult matter to interfere with."

Realizing the risk of doing more harm than good by ill-advised meddling with industries in the supposed interest of the workers, Mr. Asquith has wisely selected four of the most important of the "noxious" class of industries for investigation by a special Committee of Experts, whose reports are now coming in; and upon these data the Home Secretary says he hopes to be able, with the general consent of both masters and men, to lay down rules which will have the effect of greatly mitigating the risks of the workers, and improving their general well-being. "That is the kind of labour," said Mr. Asquith, "in which the time of the Home Secretary is largely "spent;" and the speaker will be supported by the general sense of the community in holding that, though there is not very much to show for it, and it does not result in sensational measures either of legislation or of administration, "it does offer a very wide and a very fruitful "field for industrial and for social progress."

Mr. Lloyd Wise on Patent Law Reform.

Among other "congresses" held in connection with the Chicago Exhibition, one was on Patents, Trade Marks, and Copyrights, which was patronized by no less well-known a representative of the Chartered Institute of Patent Agents than Mr. W. Lloyd Wise. There is a certain piquancy about this, inasmuch as of all the great American institutions which the citizens of the United States are never weary of belauding, their Patent System is perhaps the most widely admired in other countries—mainly, as Mr. Lloyd Wise has often declared, by people who have not had anything to do with it. He is anything but an admirer of that system of the United States, of which he has indeed uttered some very scathing criticisms; and there was consequently a degree of appropriateness in his sending to Chicago and there having read a paper containing some suggestions for a good Patent Law—which is tantamount to hinting that there is nothing of the kind already in existence anywhere. It must be credited to Mr. Lloyd Wise's modesty that he does not, in his interesting paper, attempt the presentment of a complete code of legislation for patents for inventions. He merely submits certain proposals as worthy of consideration in this regard. The first suggestion made is that "the first applicant who "complies with the prescribed requirements in any "country should be entitled to a patent there (subject "to international arrangements), provided he has not "fraudulently obtained the invention from some other "person or persons in the country." This is advanced as expedient for several reasons. It widens the classification of eligible patentees. But Mr. Lloyd Wise thinks it is not practicable to restrict the grant of a patent to the "first "and true inventor" in the literal sense of the expression; and he would clear away the contingencies of forfeiture that cling round existing patents. The next suggestion is that "a complete specification, with the claims, should "be lodged with the application for a patent; but the "applicant or patentee should be at liberty to apply from "time to time for leave to amend his specification, claims, "and drawings, by way of disclaimer, correction, explana-"tion, or addition; and it should not be a ground of "objection that the specification as amended would claim "an invention substantially larger than, or substantially "different from, the invention claimed in the specification "as it stood before amendment." This is a tremendous innovation, and one that might be discussed at any length. Mr. Lloyd Wise further suggests that all applications for patents should be officially examined for form, morality, and anticipation; provided that prior publication or anticipation should not be a ground for refusal of the patent, if the applicant refers to it, and still persists in his claims. The sort of official examination that obtains in the United States Patent Office is denounced by Mr. Lloyd Wise as useless. Several other daring suggestions are made by the writer, which are well worthy of attention. Among other things, it is to be noticed that he agrees with the retention of the system of moderate periodical payments, as a means of killing off worthless and unworked patents. If any country is pondering the introduction of a Patent Law or the reform of an old one, it might be well for the Legislature of that country to send for Mr. Lloyd Wise, and entrust him with the job. For further remarks on the same general topic, we may refer to the opening address delivered by Mr. Lloyd Wise before the Chartered Institute of Patent Agents.

WATER AND SANITARY AFFAIRS.

Commencing with the period in which Mr. E. J. Smith's terms for the acquisition of the London Water Supply were rejected by the House of Commons, Mr. Alfred Lass's annual "Analysis of the Accounts of the Metro-"politan Water Companies" has reached its thirteenth year of publication. Subject to some improvements, the tables retain their original form; but the figures undergo a change which marks the growth of the great Metropolis, and the continued increase of the population occupying the extensive area included in the districts of the eight Companies. In 1880, as shown by the "Analysis" for that year, an average daily supply of about 142 million gallons proved sufficient for London and its suburbs; whereas in the past year the quantity largely exceeded 186 millions. Between these dates, the net water-rates rose from £1,441,000 to £1,898,000, and the price per 1000 gallons has fallen by a small fraction, while the net profit *per quantum* shows a more marked decline. At the same time, by good management, the rate of trading profit has slightly advanced. The cost of pumping and filtration, in proportion to the quantity of water dealt with, remains much as before. But there is one item which has been more than doubled; rates and taxes, exclusive of income-tax, being £186,000 last year, as compared with £90,000 in 1880. There is even a rise of more than £7000 on this account as between 1892 and the year preceding. Notwithstanding an addition of more than four million gallons to the average daily supply, the cost of pumping last year was less than in 1891. Filtration necessarily cost more; the increased expenditure being considerable. The expense of pumping per 1000 gallons fell; while for filtration there was a rise. We have mentioned the total of the net water-rates; but it is interesting to observe that the gross amount has at length reached £2,000,000, and even slightly exceeds this sum. The net profit is considerably under a million; but it is £39,000 more than in 1891, and bears an increased ratio to the stock and share capital. The total capital employed at the close of the year was nearly 15¼ millions. Twelve years earlier, the capital account was less by £2,793,000. Yet the amount per 1000 gallons has fallen very nearly 8 per cent. It cannot, therefore, be said that capital has been unduly increased. The financial results go to prove that Mr. Smith's provisional bargain with the Companies in 1879 was not such as Sir William Harcourt and his Committee declared it to be in 1880. Concerning the supply itself, the reality of the progress made in the extension of the constant service is shown by the circumstance that the number of houses so served was augmented by 43,000 during the year, while the increase in the number of houses supplied with water was 11,427. Out of nearly 792,000 houses served with water in December last, more than 544,000 had the constant supply. At this rate, we may expect that the system will have become universal in the course of eight years. Many other results might be deduced from Mr. Lass's figures; but these will suffice to show the character of the work to those who are not already familiar with its ample and excellently arranged data. Figures are sometimes confusing; but all is clear in this ingenious "Analysis," notwithstanding the mass of detail which covers the pages. A vast amount of labour must have been expended on the calculations, so as to give the statistics in such a form as to save the reader any trouble beyond that of simply picking out the figures he happens to want. Some useful information is also appended, as to rates of supply and other matters affecting the rights and obligations of the Companies.

Water consumers are not disposed to be too appreciative of the advantages they derive from an efficient and constant supply. Some—perhaps a good many of them—seem to grudge the payment of even the most moderate water-rates, and regard the collector as their natural enemy, who must and should be withstood and put off upon every possible pretext. The East London Water Company, having waived their statutory right to cut off the supply, find it necessary to issue a great number of summonses; and upon the hearing of several of the cases in the Thames Police Court, as reported in last week's Journal, the Company's Solicitor made special reference to the question of costs. His object—and it was a very proper one—was to let defaulters know that they could not defy the Company with impunity. If, he

added, the defendants were let off with the bare costs of the summons, he was afraid hardly any one would pay until the summons was served. The reasonableness of this contention, we are happy to observe, commended itself to the Magistrate (Mr. Rose), who expressed the opinion that the Company were clearly entitled to costs. This view, to which his Worship gave due effect in the cases before him, cannot be too widely known. Water consumers of the class in question are always prepared to pay something for delay; but it may be that the prospect of having to submit to a really substantial addition to the actual water-rate will induce them to consider that the "game" of delay is not worth the "candle" in the shape of costs.

Since it may become more and more necessary for the Water Companies to resort to the Police Courts for the purpose of enforcing rates and penalties, it is a matter for regret that magisterial procedure, where the Companies are complainants, has not been placed upon a more uniform and consistent basis. Most of the Special Acts obtained by the Companies incorporate the provisions of the Lands Clauses Consolidation Act, 1845, the Companies Clauses Consolidation Act, 1845, and the Water-Works Clauses Act, 1847. Each of the two first-named Acts contains provisions for the enforcement of penalties; and the Act of 1847 incorporates for a similar purpose the Railway Clauses Consolidation, 1845. In this way, ample jurisdiction is conferred on a Stipendiary or on unpaid Justices. In fact, the jurisdiction is redundant, and therefore puzzling; whereas in such matters simplicity is a thing greatly to be desired. Where, under a modern Special Act, penalties are enforceable, it is sometimes necessary to refer to the original Special Act and all the general statutes above mentioned before the legal position of affairs can be reliably ascertained.

Mr. T. Newbigging and the Rossendale Valley.—The Mayor of Bacup has suggested that the freedom of the borough should be conferred upon Mr. T. Newbigging, for the many distinguished services which he has rendered to the district. Bacup is the principal town of the Rossendale Valley, whose history Mr. Newbigging has written, and with whose literature and traditions his name is inseparably connected. Our readers may remember that it was for the Rossendale Division that Mr. Newbigging stood as a parliamentary candidate in 1886.

The Management of the Selkirk Gas-Works.—Mr. J. D. Smith, son of Mr. J. Smith, Manager of the Hawick Gas-Works, has been appointed Engineer and Manager of the Selkirk Gas Company. He received his early training with Messrs. J. Melrose and Sons, of Hawick, as a mechanical engineer; devoting his leisure time, with much success, to the study of science and art. He acquired a thorough knowledge of chemistry in its application to gas manufacture; and having filled the position of Assistant-Manager to his father, he has had the necessary practical experience to fit him for the discharge of the new duties he has undertaken.

Electrolysis and Water-Pipes.—At the recent meeting of the American Water-Works Association, at Milwaukee, Mr. Peter Milne read a paper on "Electrolysis and its Effects upon Water-Pipes." In the course thereof he remarked that, as the perishable nature of metals buried in the earth was one of the greatest difficulties with which the water-works engineer has to contend, it was additionally unfortunate that this should be even increased by electrolysis. If glazed earthen pipes were used, this difficulty would be largely overcome, as they were not subjected to its action. Various lead and iron pipes in greater or less degrees of oxidation and decomposition caused by electrolysis were placed in evidence, and discussed by the delegates. Mr. Benzenberg related some of his experiences in Milwaukee, owing to the grounding of the current used by the street railway some years ago. He displayed a piece of a large ½-inch iron pipe eaten through to the thickness of about a knife-blade, which had caused disastrous leaks. He said it was also discovered that the street railway companies had been in the habit (without either permission or notice), wherever practicable, of connecting their return wires, as well as the rails themselves, with fire hydrants all over the city. A compromise had now been made by the railway companies, who agreed to reduce the number of such hydrant connections to 50, and also to establish a proper means for the current to leave the water-pipes with the least possible resistance opposite the generator in the power house; thus facilitating the return current as far as possible, and so reducing its disintegrating effect upon the mains. Mr. W. Alexander, a delegate, asked if this connection with the hydrants did not create a possibility of having a short circuit, and thus endangering the lives of firemen handling hose from that hydrant if the stream should happen to strike the trolly wire itself. Mr. Benzenberg said he thought this danger was only slight, though it probably did exist.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 774.)

THERE is not the slightest improvement in business on the Stock Exchange, nor any sign of it. So far as last week is concerned, the tendency was even the other way; for things seem to be getting gradually quieter. The utter stagnation of business is becoming really serious in Capel Court. Incidents during the week have been few; and they have not been encouraging. The promise of an early termination of the coal strike has not borne fruit. The masters and the men are again far apart; and violent scenes have recurred. Meanwhile, home trade is dying a lingering death. Across the Atlantic, the champions of free silver are making an obstinate resistance; and a disastrous compromise may yet be the result of their stubborn tactics. Upon the Continent, the theatrical farce which is being played in Paris and Toulon is entertaining; but it is not business, and it does not touch the market. The Money Market continues very dull, and is likely to remain lethargic, so far, that is, as it is possible to foresee. The Gas Market has shown more activity when contrasted with the previous week, though that is a low standard of comparison. Changes of quotation are very few indeed; but, on the whole, the tendency was favourable. Gaslight "A" was moderately active, and the quotation has been advanced 1½; but marked transactions were somewhat unsteady and variable in price. The secured issues were very animated, owing largely to the demand for investments for money; and the "G" 7½ per cent. rose 5. South Metropolitans were very little dealt in; and the prices marked were a fair medium. Commercials opened with some show of activity; but it did not last, and no more business was done all the rest of the week. Among the Suburban and Provincial Companies, Brighton and British alone exhibited any activity. Transactions in each were marked at good figures; but quotations did not move. Of the Continentals, Union and European were very firm; but Imperial was out of favour, and receded another point. None of the undertakings in other parts of the world made any sign. Business in Water stocks was on about the average scale. Firmness was the general characteristic; and one or two issues effected a slight advance.

The daily operations were: The Gas Market showed signs of revival from its apathy of the previous week; and prices were pretty fair all round, though quotations remained unchanged. No further progress was effected on Tuesday; but prices held their own generally, and Gaslight "G" 7½ per cents. advanced 5. In Water, Chelsea rose 2; and Lambeth 10 per cents., 1. Transactions were marked to an increased extent on Wednesday; and an advance of 1½ was made in the quotations of Gaslight "A." But the business recorded did not show much variation in the figures at which the stock was changing hands. Little alteration was observable on Thursday—prices generally keeping well up, but not further improving; while Imperial Continental was a point lower. This position of affairs continued till the close of the week, without any additional variation in the quotations.

ELECTRIC LIGHTING MEMORANDA.

Major Flood Page on the Incandescent Lamp Industry—Gas-Engines for Electric Light Stations.

THE expiration of the incandescent lamp patent on the 10th prox. has furnished the occasion for many public utterances of interested parties, not the least amusing of which is a report of an "interview" with Major Flood Page, the Secretary of the Edison-Swan Company, appearing in the current *Pall Mall Budget*. The interviewer began promisingly by avenging himself on the Major, who proved to be most irritatingly, if diplomatically reticent, by "sarcastic allusion to the fact that the man who controls the incandescent lamp industry of England has his own house lighted by gas." This home-thrust was met by the victim gallantly with the declaration that it was "another story, and a long one." Major Flood Page went on to say that, in his opinion, the effect of the cheapening of the incandescent lamps upon the electric lighting industry would not be very marked; and he feared the enthusiasts would be disappointed. This is so exactly in accordance with our own belief, that we must be allowed an expression of satisfaction at finding ourselves in accord—not for the first time—with the perspicacious Secretary of the Edison-Swan Company. Major Flood Page is a model for all "interviewed" notables. He tells a very interesting and candid story; and, when asked a question which he has no intention of answering, he disguises the refusal in something of apparently equal value. Thus, when pinned by the query whether an ordinary incandescent lamp costs about 9d. to make, as commonly stated, he replied that it is "impossible to say. They vary enormously in price. Some kinds of lamps have six shillings' worth of platinum in them. Some cost ten times as much as others. We have never estimated the cost of an ordinary 16-candle power lamp, because we could not do so." The statement is worthy of the diplomatist who made it. The prime cost of an article of manufacture which has been so long upon the market as the Edison lamp is

not "estimated;" it is known to the second place of decimals of a penny. It is easy to agree with Major Flood Page in his confident declaration that, notwithstanding the impending loss of their monopoly, his Company "have many advantages still." They have the trade, at any rate; and if they lose it, they will deserve their fate.

Mr. J. A. M'Mullen writes to the *Electrical Review* to make public profession of his faith in the gas-engine as the motor for central station lighting plants. The letter was evoked by the publication of an illustration of a very nice-looking three-cylinder gas-engine, of the vertical pattern so fashionable just now for marine purposes. Mr. M'Mullen remarks that he has been endeavouring for some time past to convince gas-engine manufacturers that the high road to success lies in the multiplication of impulses, and not in the employment of excessively high speeds and heavy fly-wheels. He is not singular in this respect; for we have repeatedly urged the same thing, and put upon record our disappointment with the commonplace gas-engines shown at the last Crystal Palace Electrical Exhibition. Mr. M'Mullen says that, in response to his suggestions, Messrs. Dick, Kerr, and Co. have manufactured an engine embodying his ideas, and having two impulses per revolution—one for each "beat" of the piston. This last is a strange expression, surely, for the reciprocating action of a cylinder-engine. However, the new pattern of engine, which develops 80-horse power, has been put down at the Rugby Electric Light Company's station, where it drives a 50 kilowatt Mordey alternator. The continuous impulses are produced by two cylinders placed tandem fashion; so that there are only two main bearings, and only one connecting-rod. The engine is supplied with Dowson gas; and doubtless the working results will be found to be economical, although the plant has not yet been running long enough to afford any definite figures for publication. As Mr. M'Mullen says, with reference to Messrs. Weyman and Hitchcock's engine, the vertical marine type should have much to recommend it, if sufficient stability can be obtained. It means at least a great saving in floor-space.

THE CRYSTAL PALACE GAS ACT.

In the article last week on the Gas Acts of the present year, it was not possible to deal adequately with the provisions of the important Act obtained by the Crystal Palace District Gas Company. This we are now in a position to do.

The Crystal Palace District Gas Act converts the existing ordinary capital of the Company, consisting of £75,000 with a maximum dividend of 10 per cent., and £275,000 with a dividend of 7 per cent., into an equivalent amount of £535,000 of ordinary stock, all paid up, with a uniform standard dividend of 5 per cent. The existing preference capital of £50,000, with a dividend of 6 per cent., is also converted into £60,000 preference stock, with a dividend of 5 per cent. Whenever the £37,500 debenture stock with interest at 6 per cent. shall have been fully paid up, the Company are to convert the same into a sum of £45,000 debenture stock bearing interest at 5 per cent. Further capital to the amount of £100,000 is authorized to be issued as 5 per cent. ordinary share capital or stock. The purchase-money of such capital is to be paid within three weeks after the sale. Unsold stock may be offered to existing stockholders, to consumers, or to employees of the Company. It is enacted that if the clear profits of the undertaking in any year amount to a larger sum than is sufficient to pay the dividend on the preference capital and on the ordinary capital of the Company at the authorized rates, the excess, or such portion of it as is not carried to the insurance fund, is to be put to the credit of the divisional profits of the undertaking for the next following half year, subject to the proviso that the Company shall not carry forward a larger amount than £20,000 in any year. A reserve fund may be formed, at the expense of the Company, out of profits applicable to dividend, and not otherwise.

The initial price for 15-candle gas is fixed at 3s. 2d. per 1000 cubic feet, subject to the provisions that "in respect of any year during which the price charged by the Company shall have been one penny or more above the standard price, the dividend payable by the Company shall, in respect of each penny by which the standard price shall have been increased, be reduced below the standard rate of dividend by 2s. 6d. on every hundred pounds of ordinary paid-up capital, and so in proportion for any fraction of one hundred pounds; and in respect of any year during which the price charged by the Company shall have been one penny or more below 2s. 10d. per 1000 cubic feet, the dividend payable by the Company may, in respect of each penny by which the price may have been reduced below such price of 2s. 10d. per 1000 cubic feet, be increased above the standard rate by 2s. 6d. on every hundred pounds of ordinary paid-up capital, and so in proportion for any fraction of one hundred pounds." The Company are not to charge any local authority a higher price for gas than the lowest rate charged for the time being to any private consumers. In addition to the sum already created and issued as debenture stock, the Company must, before raising any portion of the ordinary or preference capital authorized by the Act, from time to time raise, by the creation of debenture stock, such further sum or sums of money as will, together with the sum already created and issued, make the aggregate amount up to £60,000. Thereafter the Company must, for every sum of £10,000 raised as ordinary or preference stock, raise a further sum of debenture stock of £20,000, until that stock is equal to, but not in excess of one-third part, including premiums, of the capital of the Company for the time being paid up; and then the two classes of capital are to be maintained as nearly as may be in the same proportion to one another. No money raised on loan is to be converted into capital; and borrowed money is only to be obtained in the form of debenture stock.

The quality of gas is to be 15 candles. Within six months from the passing of the Act, the Company are to establish a new testing-place, with all necessary apparatus, at the office of the Beckenham Local Board, who are to provide a proper and sufficient room for the purpose; and all local authorities outside the Metropolis and within the district of the Company will have access to, and be at liberty to use, this testing-place. The prescribed burner for testing the gas is Sugg's "London" Argand No. 1. For the purpose of ascertaining the quantity of light given by 5 cubic feet of gas per hour, candles shall be used as hitherto until some other method is adopted by Parliament or the Board of Trade in reference to gas supplied in the Metropolis; and thereupon and thereafter the method so adopted shall apply to gas supplied by the Company. It is provided that it shall not be necessary to apply more than a single test. "No forfeiture is to be incurred in any case with respect to which it is proved before the Justices that the defect of illuminating power or excess of impurity was occasioned by unavoidable cause or accident; or in the case of an excess of sulphur, unless that excess shall amount to two grains upon the average of six consecutive week days, or ten grains upon any one day." In the event of the gas examiner finding any defect of illuminating power or purity in the gas, he is to forthwith give notice thereof to the Company.

The Company are authorized to enter into an agreement with the South Metropolitan Gas Company for the use of their landing-stage at East Greenwich; and also for an amalgamation of the two undertakings, subject in the latter case to the amalgamation provisions of the South Metropolitan Act of 1876. Interest at the rate of 5 per cent. per annum is to be paid on consumers' deposits.

WATER ACTS FOR 1893.

In the JOURNAL last week, and in the preceding article, we have dealt with all the Gas Acts of the present year. We now notice those relating to water supply.

Only two new Water Companies were incorporated by Act of Parliament in the recent session. The Frimley and Farnborough District Water Act incorporates a Company for supplying water in a district comprising the parishes of Farnborough and Crondall and the tithings or chapelries of Cove and Hawley and the village of Blackwater, in the parish of Yateley in the county of Hants, and the parishes of Frimley and Ash in the county of Surrey. The share capital is fixed at £36,000, with power to borrow to one-fourth of this amount. The works authorized consist of a pumping station and collecting reservoir of a capacity of 100,000 gallons, situate in a field adjoining the London and South-Western Railway at Sturt Junction. There is also a connection with the Basingstoke Canal; and the Company are empowered to take the water which now flows alongside the London and South-Western Railway into the Blackwater. A service reservoir is to be constructed on the Frith Hill. Certain sums are to be paid to persons named in respect of waters proposed to be taken. The lands required by the Company are to be acquired within three years, and the works constructed within five years. In the event of the Company exercising the powers conferred upon them for taking water from the Basingstoke Canal, it is enacted that they are not to draw more than 200,000 gallons in any one day, and are to pay for it at the rate of 1d. per 1000 gallons; but the payment is not to be less than £150 per annum, payable quarterly. Part of the Frimley Wharf is to be used as an underground filter-bed. Rates for domestic supplies are to range from 9 to 6 per cent. The Company are authorized to enter into agreements with the Aldershot Gas and Water Company and the Woking Company for the purchase by, and sale to the Company of water in bulk. The Company are required to issue to the Woking Company 500 fully-paid £10 shares, besides a like issue representing at par value the costs incurred by the Woking Company in respect of the Act. All dividends received by the latter Company in respect of these shares are to be carried to the credit of their revenue account. The profits of the Company available for dividend are to be applied as follows: First, to the payment of 5 per cent. on their capital, not including the special issue to the Woking Company of 500 shares, and not exceeding £1250 in amount; second, in payment of 5 per cent. on the Woking Company's special issue; third, in paying further dividends on all capital without distinction. It is provided that until the last condition is attained the Company are not, except with the consent of the Woking Company, to pay more than £360 by way of interest on borrowed money. On the completion of the special issue to that Company, certain statutory powers appertaining to them in the district of the new

Company are to be transferred, and their borrowing powers to be modified. A clause is inserted in the Act for the protection of the War Department.

The West Hampshire Water Act incorporates a Company with a share capital of £50,000, and the usual borrowing powers, for the purpose of supplying the township and borough of Christchurch and the parishes of Sopley, Ringwood, Milton, Holdenhurst, Brockenhurst, and Lyndhurst, in the county of Southampton. There is a time limit fixed for the operation of the Company's powers, varying from eighteen months to seven years for different portions of this district. The source of supply is to be a well in a field near Knapp Mill, situate between the River Avon and the London and South-Western Railway. Water may also be taken from the river under certain conditions. Compensation is to be paid for any rights to be acquired by the Company over the common lands of the New Forest. The water supply is to be laid on under pressure for at least two hours in the morning and a like period in the evening; the hours as regards Christchurch to be selected by the Corporation, and as regards other places to be arranged to the reasonable satisfaction of the Local Authorities. Rates for domestic supply are to range from 9 to 6½ per cent. Power to purchase the undertaking at any time is given to the Corporation of Christchurch, including the necessary authority to the latter to borrow money, &c., for acquiring the property; and the Local Authorities are also empowered to acquire from the Corporation the portions of the undertaking in which they may be interested.

The Accrington Gas and Water Works Act confers upon the Company authority to raise £56,000 of new "C" water capital, with the usual borrowing powers. The accounts of the two undertakings are to be divided. The existing water capital is stated at £130,000, of which £6000 is called "A" water capital and the remainder "B" water capital; and the borrowing powers in respect of the same are defined to be £29,600. Future dividends upon the respective classes of gas and water capital may be uniform. The Bodmin Water Act extends the limits of supply by the Company to the parishes of St. Breward, Blisland, Helland, St. Malyn, and Lanivet, in Cornwall. The capital of the Company is increased by £12,000, with the usual borrowing powers; and an additional supply of water is to be taken from the parish of St. Breward, where a new reservoir is to be constructed. The Company are required to supply the County Asylum after the rate of 40,000 gallons per day, in consideration of a payment of £3500, which sum is to be applied towards the redemption of old mortgages. Any further quantity of water required for the Asylum is to be paid for at the rate of 1s. per 1000 gallons. This capital sum is to be repayable without interest to the County Council, in the event of the Company failing to supply the Asylum as enjoined by the Act. The Company are not to borrow any money until this payment is disposed of. The Company are to construct a fish-pass, to the satisfaction of the Board of Trade, on their weir at Dunmere, on the River Camel.

The Devonport Water-Works Act empowers the Company to take on lease from the owners of the Maristow Estates, for the period of 999 years, at an annual rent of £7, certain lands in the parish of Walkhampton for the purpose of increasing their works. The limits of supply are defined and extended. The undertaking is to be sold, so far as it applies to Stonehouse, to the Stonehouse Local Board, for a gross sum to be agreed upon; and the necessary powers for the acquisition and carrying on of this portion as a separate undertaking are conferred upon the Board. The South Staffordshire Water-Works Act authorizes the Company to raise £150,000 of further capital, with the usual borrowing powers, and to construct additional works, comprising two service reservoirs in the township of Great Barr, to be completed within seven years. The rights of the Company are defined as regards Wordsley, with reference to those of the Stourbridge Company; and the Corporation of Wednesbury are also protected. The Directors are authorized to prepare, not latter than the end of 1896, a scheme for the consolidation of the existing preference stocks into a uniform 4 per cent. preference stock; and if such scheme is approved, it is to take effect. In the event of non-acceptance of their first scheme, for any reason other than the disapproval thereof by the proprietors of the Company, the Directors may prepare a second scheme not later than the end of 1898. The rate of charge for water supplied to public authorities is fixed at a maximum of 7½d. per 1000 gallons to any urban sanitary authority consuming upwards of 3,200,000 gallons yearly. The term "public purposes" mentioned in the Water-Works Clauses Act, 1847, is extended to include "public fountains, drinking-troughs for cattle, and public urinals established by such urban sanitary authority for the free use of the inhabitants, and also public baths, wash-houses, and water-closets belonging to the urban sanitary authority, notwithstanding a charge is made for their use." The rates chargeable for domestic supplies in the Dudley district are assimilated to those allowed by the South Staffordshire Water Works Act, 1853. Within two years, the Company are required to spend £3000 in providing Walsall with large mains, and to spend £3500 for the same object in West Bromwich. If required by any urban sanitary authority, the Company are to furnish and fix pressure-gauges for the purpose of "ascertaining more easily and effectually whether the Company are complying with their statutory obligations." The Company are enjoined to provide, at their own expense, telegraphic or telephonic communications required for fire brigade purposes. Water is to be supplied gratis for fire brigade practice once a month.

The Barry and Cadoxton Local Board (Gas and Water) Act provides for the purchase by the Local Board of the Company's undertakings, in accordance with the terms of a scheduled agreement; the consideration being apportioned to the respective portions of the property by Mr. Charles Hawksley. Money borrowed for the purchase of the water undertaking is to be repaid in 50 years. Portions of the undertakings lying within the district of other Local Authorities may be sold to the latter. The Runcorn Commissioners Act authorizes the Runcorn Improvement Commissioners to acquire the undertaking of the Runcorn, Weston, and Halton Water Company according to the terms of a scheduled agreement, which states the consideration at the lump sum of £67,500. The East Stonehouse Water Act empowers the Local Board for the District of East Stonehouse to extend and improve their water supply by taking, under the terms of a scheduled agreement, an additional quantity of water in bulk from the mains of the Plymouth undertaking. The Act also contains the usual regulations and provisions applying to a constant supply. The Aberdeen Corporation (Gas and Water) Act contains provisions enabling the Corporation to borrow £70,000 upon water-works account. The existing sinking fund regulations are abolished, and a new sinking fund is to be formed by setting aside not less than 3 per cent. per annum upon the amount of borrowed money. Additional works are to be constructed, comprising a settling reservoir at Invercannie and two service reservoirs at Kittybrewster, all to be completed within seven years. A special district is constituted at Braemar, with the object of preventing pollution of the River Dee; and agreements concluded to the same end with the Deeside District Committee and the Ballater Police Commissioners are confirmed. The Belfast Water Act provides for an additional supply of water to the district, and authorizes the construction of a new storeage reservoir in the valley of the Kilkeel River in the Mourne Mountains, with the necessary subsidiary works, under the condition that the Commissioners shall do as little damage as may be, and shall make full compensation to all persons for damage sustained by them in consequence of the exercise by the Commissioners of the powers conferred upon them by this Act. For these purposes the Commissioners are authorized to borrow £875,000. Power is also given to them to borrow on cash credit from their bankers. The Commissioners may supply water for hydraulic power purposes. It is enacted that, in connection with legal proceedings taken by or on behalf of the Commissioners, it shall not be necessary to prove the appointment or authority of any representative of the Commissioners, or to prove any resolution of the Commissioners. Power is taken to establish telegraphic communication between the different stations and offices of the Commissioners. It is rendered illegal to affix any tube or hose to a water-fitting without the written consent of the Commissioners; and it is declared that a supply of water for domestic purposes does not include a supply for use in any club, hotel, barrack, or institution of a public nature. Certain persons are to be compensated in money for the abstraction of water from the Kilkeel and Annalong Rivers authorized by the Act, as well as for damage done by fouling water, &c., during the progress of the authorized works.

The Bilston Commissioners (Water) Act confers further powers upon the Bilston Township Commissioners with respect to the construction of water-works and the supply of water within their district. It confirms an agreement between the Commissioners and the Corporation of Wolverhampton for the supply of water in bulk by the latter to the former at the price of 5d. per 1000 gallons. Certain works to be undertaken by the Commissioners are also sanctioned, including wells and pumping stations in the parish of Wombourne, situate in lands adjoining the Staffordshire and Worcestershire Canal. An agreement with a landowner with reference to the possible injury of tenants by pumping operations is also scheduled. The Commissioners are to keep separate accounts of their water undertaking, and provide for the extinction of the debt on the same by a 3 per cent. sinking fund. The Dublin Corporation Act authorizes the Corporation to borrow for water-works purposes an additional sum of £120,000, to be repaid within 60 years, by the issue of Dublin Corporation redeemable stock. The Greenock Corporation Act contains a clause enabling the Water Trustees to borrow £20,000, repayable in 60 years. The provisions applying to the redemption of the water capital are also revised. The Liverpool Corporation Act provides, among other things, that on the appointed day all the Corporation stock representing the old water-works debt is to be cancelled, and the necessary alterations made in the Corporation and Bank of England books. Section 36 of the Liverpool Corporation Loans Act, 1880, is repeated; and, in lieu thereof, an annual payment of £50,000 is to be made, and left to accumulate at compound interest until the whole of the balance of the old water-works debt shall have been repaid. The remainder of the Act relates to various detail matters arising out of the rating of Liverpool and the administration of the water-works undertaking. The Plymouth Corporation Water Act empowers the Corporation

to enlarge their water-works by the construction of an impounding reservoir at Burrator, upon the River Meavy, subject to many provisions and liabilities, the works to be completed within seven years, The Corporation may borrow for the purposes of the Act £150,000, to be repaid within 60 years. The Rathmines and Rathgar Township Acts confirms certain works as constructed for taking and impounding the waters of the River Dodder, subject to provisions for compensation which have formed the subject of an action carried to the House of Lords. The sum of £25,000 is to be borrowed for water-works purposes. The St. Helens Corporation Act empowers the Corporation to borrow such sums as may be required for the purchase or redemption of the rents payable to the St. Helens Water-Works Company and for the purchase of shares in that Company, and also the sum of £150,000 for other water-works purposes. The revenue of the water undertaking of the Corporation and the water accounts is made chargeable with the annual rents payable by the Corporation under the lease from the St. Helens Water-Works Company, dated Oct. 1, 1851. These annual rents are now made redeemable. The Corporation are further empowered to purchase shares in the Water Company; and certain matters of detail connected with the working of the undertaking are dealt with in other clauses. The Sheffield Corporation (Water) Act authorizes the Corporation to extend the operation of their sinking fund, enlarges the period assigned for the completion of certain reservoirs, and restricts the application of the district rate in the matter of providing for deficiencies of the water-rate. The Stirling Water-Works Act authorizes the Commissioners to acquire additional lands for increasing their filtering area, and to construct the filtering and settling works described. For the purpose of providing for the better distribution of water among the inhabitants, the owners of dwelling-houses not properly supplied with water may be required to take a supply from the public mains at their own expense. The sum of £20,000 may be borrowed by the Commissioners for the improvement of their undertaking.

The Thames Conservancy Board.—At the meeting of the London County Council on the 10th inst., one item of business consisted in the selection of three members to represent the Council on the Thames Conservancy Board. Mr. C. Harrison, Mr. Bassett Hopkins, and Mr. J. M'Dougall were chosen; and they took their seats the first time at the meeting of the Board the following Monday.

Proposed Testimonial to Mr. G. Chaloner, F.C.S.—There are doubtless among our readers not a few who have profited by the instruction given in the chemistry classes at the Birkbeck Institution, which for the past quarter of a century have been conducted by Mr. G. Chaloner, F.C.S. As this gentleman has now resigned his position, it is thought that many of his old students and friends will be desirous of combining to offer him some mark of their good-will and esteem. With this view, a Committee is being formed to make arrangements for presenting Mr. Chaloner with a suitable testimonial; and we are asked to notify this fact, and to mention that Mr. E. G. Clayton, of 43 and 44, Holborn Viaduct, E.C., or Mr. Herbert Trewby, of Radnor House, Hornsey, N., will be pleased to hear from anyone desirous of associating himself with them or with the work.

Determining the Densities of Gases.—A recent number of *Nature* contained the following notice of a convenient modification of the hydrometer method of determining the densities of gases, devised by M. Meslans, whose apparatus is described and illustrated in the *Comptes Rendus*. It consists of two hollow spheres hung to the arms of a balance. Each sphere, which is made of glass, aluminium, or gilt copper, hangs in a separate compartment, the suspending thread being introduced through a hole in the lid. The compartments are enclosed in a box, and surrounded by water in order to keep them at equal temperatures. They are at first filled with air to determine the position of equilibrium. The gas of which the density is to be determined is then introduced through a long tube immersed in the water, and enters one of the compartments, having previously been dried. It is passed through in a slow and continuous stream; and if its density differs from that of air, the equilibrium of the balance is disturbed. The weight necessary to re-establish equilibrium is noted, and the density calculated according to a simple formula. Thus the density of a particular gas is found by a single weighing; and by keeping the current continuous, variation in its density is easily observed. A fairly high accuracy is attainable, depending upon the sensitiveness of the balance and upon the perfection of gauge of the spheres. One important application of the apparatus is that for determining the density and composition of the products of combustion in furnaces. The scale of the balance is graduated so as to show at a glance the percentage of carbonic acid, and hence the degree of efficiency of the furnace in question. This percentage, which is about 21 theoretically, never exceeds 18 in practice, except in gas generators. In a great number of works it varies between 6 and 8. The apparatus is being applied to the study of the various methods of heating. Another application is that by which the presence and percentage of marsh gas is indicated. With spheres of 1 litre capacity and a balance sensitive down to 0·5 milligramme, it was found possible to detect 0·1 per cent. of methane in the air of a mine.

NOTES.

Test of Fire-Resisting Materials.

An interesting test of fire-resisting materials and construction was recently carried out in Berlin, under the auspices of the Fire Brigade and the Insurance Companies of the city. The idea of the tests was mooted as far back as 1889; but there was considerable difficulty in arranging for a series of "fires," which were intended to be as "natural" as possible, and yet should not be dangerous. Finally, the Municipality gave the experimenters the use of an old warehouse for their purpose; and this building, having been fitted up to represent various types of fire-resisting structures, was duly set on fire. Care was taken to subject the exhibits to the temperatures, irregularities of heating, sudden shocks by falling weights or jets of water, &c., which generally occur at conflagrations; and it was found possible to take fairly exact observations. Among the most satisfactory results obtained were with the fire-resisting glass made by Messrs. Siemens, of Dresden. The assessors declare it to be most suitable for any skylight or window necessary in a division between separate risks, as it will resist a temperature of 1300° C. for half an hour and more; bearing all manner of shocks and strains without suffering appreciable damage. Care is required in fixing this glass, however, as the iron frames generally used for the purpose buckle under heat, and show, between the glass and iron, openings through which flame can pass. Some of the so-called fire-proof floors made of iron girders and concrete came to speedy grief in these tests; while iron and brick floors stood very well, as did the "Monier" construction (as to which reference has been already made in the JOURNAL). As regards fire-proof doors, nothing stood better than double oak covered with thin sheet iron, between which and the wood there should be a layer of asbestos cloth. Seeing how many warehouse fires are propagated through windows, the assessors attach great importance to their demonstration of the capability of Siemens glass for withstanding flame.

A Closed-Circuit Gas-Engine.

Mr. George H. Chappell, of New York, has invented a truly remarkable description of gas-engine, which greatly surpasses in ingenuity of conception the far-famed Keeley Motor. It is an engine designed to work in a closed circuit, starting with a store of gas compressed in a reservoir. The combination also includes a compressing pump, a heat-absorbing chamber surrounding it, a coil of pipe from the gas reservoir located in the chamber, a motor engine connected to the coil, another power cylinder communicating with the exhaust of the motor engine, and arranged to operate the compressing pump, a heating apparatus for imparting heat to the cylinders of the motor engine and the power cylinder, and a connection between the exhaust of the motor engine and another gas reservoir, which is in turn connected with the first gas reservoir by a pipe thoughtfully provided with a stop-valve. The compressed gas is evidently to do work by expanding, and restore work by compressing itself afterwards. The heat rendered sensible by compression is to warm up the gas during expansion; and all the gas used is to find itself stored again, at the end of the circuit, at the same pressure it had to start with. Obviously, economy in gas-engine working can no further go.

The Preparation of Hydrogen.

An interesting example of the capacity of some of the oldest and most hackneyed chemical reactions for improvement is supplied by a communication of Mr. John Ball, of the Royal College of Science, South Kensington, to the *Chemical News* upon the preparation of hydrogen by the ordinary zinc and acid laboratory apparatus. Mr. Ball states that he has recently observed that, by the addition of a few drops of a solution of nitrate of cobalt to the acid and zinc, the rate of evolution of hydrogen is enormously accelerated, especially at the beginning of the reaction. The effect is the same with either hydrochloric or sulphuric acid; and a couple of drops of solution of nitrate of cobalt will suffice for a large quantity of acid. The action does not seem to have been noticed before; and it should be useful in the rapid preparation of hydrogen in the laboratory. Most, if not all, of the cobalt salt is quite unaltered. There appears to be a very thin film of cobalt deposited on the zinc, which probably acts with the zinc as a voltaic couple; but the amount of cobalt deposited appears to be too small to weigh. There is no particular virtue in the cobalt in this regard; for a solution of a nickel salt exerts a similar action.

Andreoli's Ozonizers.

An interesting account of M. Andreoli's apparatus and method for the commercial production of ozone has appeared in the *Chemical Trade Journal*. It is recounted that the first attempts in this line were made in 1857 by Siemens, who devised a ozonizer consisting of two tubes of thin glass placed one within the other. The outside of the outer tube and the inside of the inner tube were coated with tinfoil, and connected respectively to the poles of an induction coil. Numerous experiments in the same direction have since been made by different inventors but none has been commercially successful. M. Andreoli claims to have solved the problem; and he has works at Bethnal

Green for the production of ozone upon a commercial scale. Here there is a complete plant, consisting first of a blower which forces air through a filtering-box. From this vessel, which is provided with cotton wool grids, the air issues, to be cooled in a refrigerator, and is then dried by passing through a sulphuric acid and coke scrubber. The air is then admitted to the ozonizer proper, which is a box containing frames of serrated wire grids put together with glass and tinfoil in electrical connection with a 10,000-volt Swinburne transformer worked by a Pyke and Harris 1-unit alternator. Such a set of apparatus is stated to yield 250 cubic feet of well-ozonized air per minute. M. Andreoli's latest improvement in this kind of apparatus is an open luminous ozonizer. He states that large vacuum tubes can be illuminated by transformers, and the effect of the opalescent luminosity is described as being very pleasant, while at the same time a strong smell of ozone pervades the atmosphere. This combination of light and ozone ought to prove extremely "fetching;" and it must soon settle once for all the moot point of the desirability of ozone in the air breathed by living beings. The principal uses of artificially made ozone are, however, to be sought in various chemical industries.

Mr. D. R. Steuart on Dangerous Lamp Oils.

Writing to *Engineering* on the subject of safe lamp oils, Mr. D. R. Steuart, of Broxburn, declares that at least 200 lives are sacrificed in the United Kingdom every year through the legislative mistake of allowing lamp oil to be sold with a flash-point of 73° Fahr. He warmly advocates raising the safety-point to 100° Fahr., which would have the effect of shutting out all dangerous foreign oils. He admits that lamp explosions only take place under exceptional circumstances; but he denies that there is anything mysterious about them. The explosive mixture is practically always present in the lamps of the poor; but it does not go off unless a light is applied to it. A wick fitting properly is a nearly perfect preventive; otherwise there would be explosions by the thousand every evening. As it is, it is only when the wick is exceptionally small, or when it is turned down into the reservoir, or the reservoir is broken in some way, that the light gets at the mixture. The poor, says Mr. Steuart, know how to be careful; but, being ignorant, they sometimes court danger by, for instance, leaving one burner of a duplex lamp designedly empty. It is a disgrace to the Legislature that the danger is always lying in wait for users of cheap lamps and cheap oil. All this is an argument for popularizing the use of gas among the poor.

Value of Coke in Madrid.—According to the Madrid correspondent of *Industries and Iron*, the make of coke at the gasworks in that city has been so considerably reduced on account of the introduction of electric lighting, that in the coming winter it will fetch a very high price. He states that even now it is sold for £3 5s. per ton, excise duty paid. At some coal mines, coke is being produced in large quantities to compete with the gas-works; but, notwithstanding this, a great deal is imported from England.

Petroleum in Peru.—According to statements lately published, the American Standard Oil Company have in Peru lands extending over an area of about 1000 square miles, part of which, for 200 miles north of Talara (which lies to the north of Paita), and inland for a distance of 16 miles, is an oil region. The first well bored yielded, at a depth of about 300 feet, a flow of 180 barrels of petroleum daily. Up to the present, the Company have drilled 26 wells, and have found oil in every instance. They are now handling about 100 tons of crude oil per day; the possible output being 100 barrels per day per well. The depth at which the oil is found is not more than 500 feet; whereas in the United States the depth is from 2000 to 3000 feet. The distilled product is sold along the coast, while the crude oil has a large sale at Callao for use by gas companies, for stationary engines, and for railway locomotives, as a substitute for coal, of which it is only about half the price.

An Unworked Store of Coal.—Considerable speculation has lately been caused in the Wallsend district by a number of workmen being employed repairing the masonry at the mouth of a shaft close to the Wallsend village green, and the erection of plant for the purpose of descending to the workings below. The colliery, which was named the Gas Pit, has been disused for many years. It is understood that the shaft leads to three seams, in one of which the coal was of such an inflammable character that the gas had to be conveyed to the surface by pipes, one of which projected high above the plant and engine-house. An influx of water led to the closing of the pit, near to the bottom of which many million tons of coal are said to lie unworked. It is generally accepted as a fact that the third or lower main is yet practically untouched, except by a narrow hand shaft or "staple." The impression is current in mining circles that in one of the seams there is coal to the weight of 4,668,000 tons; in another, 7,700,000 tons; and in the third, 9,700,000 tons. The workings are at present owned by the Wallsend and Hebburn Coal Company, who, it is said, intend to overcome the difficulties on account of which the shaft named and others in the neighbourhood ceased to give employment to many hundreds of families.

TECHNICAL RECORD.

THE DEVELOPMENT AND TRANSMISSION OF POWER FROM CENTRAL STATIONS.

Early in the present year, a course of lectures on the above subject was delivered before the Society of Arts, under the terms of the Howard Bequest, by Professor W. CAWTHORNE UNWIN, F.R.S. The full text of the lectures has just been published in the Society's *Journal*, from which we extract the portions which appear to have most interest for our readers.

The lecturer commenced his first discourse by saying that, in carrying out the work entrusted to him by the Council of the Society, he purposed considering energy as a commodity which could be produced, distributed, and sold. The special problem was to examine the advantages of producing the energy in a wholesale way; the means of conveying it to a distance, and distributing it to various working centres; and the relative advantages and disadvantages of such a system compared with the method of generating it in the localities where it is used. He pointed out that, as various sources of energy and methods of producing and distributing it were available, the inquiry would be a wide one; and therefore, in the time at his disposal, it would only be possible to pass rapidly in review the matters of most importance, leaving gaps which might be filled at some future time. He explained that his possessing greater knowledge of some of the older and more mechanical modes of power distribution than of the newer methods of electrical distribution was, no doubt, a disadvantage. But electrical methods had, he said, already been very fully discussed. On the other hand, there might be some advantage in approaching the subject with the bias of an engineer rather than of an electrician. Granting what no doubt was true—viz., that electrical transmission would play an important part in the development of systems of power distribution—there was, perhaps, a popular tendency at present to regard too exclusively this single method, and to overlook other means of power distribution which had been usefully applied, and would still be used in the future. Two points should be clearly kept in mind. First, that as to the production of energy in an available form, we are just where we were before modern electrical discoveries were made. The most the electrician could do was to provide a new mechanism of distribution. At present, the energy to be distributed must be developed by a steam-engine or a water-wheel; and the dynamo, cable, and electric motor merely replaced the shafting, gearing, and belting, or other mechanism of transmission—performing, he admitted, the same functions more cheaply and effectively in certain cases. The second point was that every method of transmission would be found to have some characteristic advantages fitting it specially for particular cases. It might be conceded to the electrician that the special advantages of electrical transmission were very strikingly apparent where power had to be conveyed to great distances. But such cases were likely to be rare. The remarkable mechanical and scientific success of the Frankfort-Lauffen experiment, in which 300-horse power was conveyed 108 miles with a loss of only 25 per cent., had a little misled merely popular observers. The fact must be borne in mind that the cost of the power when it reached Frankfort was five times as great as that of an equal amount of power produced directly in Frankfort by a steam-engine. Transmissions to much smaller distances were the only ones likely to be often required, and for moderate distances there was choice of various methods of transmission besides the electrical one.

Having made these introductory remarks, Professor Unwin proceeded to give some reasons for distributing power from central stations; enumerating the advantages as follows: "(1) In generating power by steam, there is economy of the cost of machinery, of fuel, and of superintendence, due to concentration of the engines and boilers in a single station. (2) In the case of water power, very often it is only possible to deal with a natural waterfall by a combination of consumers, or by an association acting in the interest of many consumers for the construction of the costly permanent works required. (3) The locality for generating power may be fixed by one set of conditions; that where it is used, by another set of conditions. It is often a question of adopting a cheaper source of power at a distance, or a dearer one near at hand. (4) Another reason for central stations arises in this way: For good or for ill, population gathers into huge communities in which there is a complex development of social and industrial life. In such communities, there is a constantly increasing need of mechanical power. For transit, for handling goods, for small industries, for lighting, water supply, and sanitation, new demands for mechanical power arise. At first these are met by the erection of scattered motors. This sporadic production of power is extravagantly wasteful, costly, and inconvenient. There is a chance in such cases that power distributed from a central station may be cheaper even when the cost of distribution is allowed for."

The lecturer then went on to say that just as it has become necessary to supersede private systems of water supply by one common service, to distribute coal gas by mains, and to establish a general system of sewerage, so it will probably be found convenient, and even necessary, to provide, in towns of a certain importance, some means of obtaining mechanical power in any

desired quantity, and at a price proportionate to the amount of the power used. It is "Socialism in the field of mechanical engineering." In illustration of this point, Professor Unwin cited the case of the London Hydraulic Power Company, who have laid down about 60 miles of mains for the supply of this kind of power for working lifts, hoisting machinery, &c. The extremely rapid extension of the system was, he said, worthy of note. In July, 1884, there were only 96 consumers taking power from the Company's mains; in 1888, there were 720; and last year, 1676. The quantity of water distributed had increased from 317,000 gallons per week in 1884 to 6,000,000 gallons per week in 1892. In no instance had the use of hydraulic power, when once adopted, been abandoned in favour of any other system of working hoisting machinery. There could be no doubt that, when power could be obtained with little trouble in a form involving no great amount of superintendence in working, and the cost was proportional to the power used, a demand was readily created. A more striking instance than the foregoing was that furnished by Geneva. A casual observer would not regard this town, with its 50,000 inhabitants, as the most likely centre for a great system of power distribution; yet it contained the largest example of the development of power at a central station, and its sale as a merchantable commodity, which had hitherto been executed. In 1871, Colonel Turrettini applied to the Municipal Council for permission to place on the town mains a small pressure-engine for driving the factory of the Geneva Society for the manufacture of philosophical instruments. In the event of finding that this method of working the factory succeeded, he asked the right to put up small motors in other parts of the town. Nine years later—viz., in 1880—there were 111 motors supplied from the town mains, which were low-pressure ones, using 212 million gallons of water annually, and paying to the Municipality a rental of £2000 a year. The cost of the water was not low; it was charged at from 30c. to 40c. per horse-power-hour, or at the rate of from £46 to £48 per annum. But even this high price did not prevent the use of power so easily obtainable. Since then a high-pressure system of distribution had been established, and power was now supplied more cheaply. The cost was about 0·7d. per horse-power-hour, or about £8 per horse power per annum. In 1889 the annual income from water sold to factories on the low-pressure system was £2085; on the high-pressure system, £4500. The receipts on the high-pressure system were increasing at the rate of about £850 a year.

The next subject dealt with was that of the various sources of mechanical energy, of which Professor Unwin said there were only three, considered practically and commercially, of industrial importance—viz., (1) the muscular energy of animals; (2) the gravitation of water falling from a higher to a lower level, and automatically restored to the higher level by the sun; and (3) the conversion of heat into mechanical energy—the heat being derived from the combustion of fuels. As to the first, the question of distribution did not arise; and with regard to the second, it would be convenient to consider it after dealing with the energy derived from heat. On the latter point the lecturer made the following remarks: By far the most important source of mechanical energy is solid fuel, and chiefly the various descriptions of coal. Coal is obtainable in very many localities, and is transportable anywhere at comparatively small cost. There are, however, certain disadvantages in obtaining energy directly from coal. First of all, there is the fact that, when burned in an open furnace, from one-fifth to one-fourth of the heat escapes with the products of combustion. Next, there is the fundamental disadvantage of the transformation of heat into mechanical energy by a steam-engine, that at most three-eighths to four-fifths of the heat supplied can be transformed—the remainder being rejected in the condenser. The three-tenths of the whole heat of the fuel which it is possible to transform by a steam-engine is further reduced by imperfections and losses in the steam-engine itself. Then the attendance required in the case of steam-engines and boilers, the risk, the difficulty of preventing smoke and of disposing of ashes, are all of them drawbacks to the general use of steam power. Many of the disadvantages of solid fuel may be diminished by employing the coal to produce gas, and using the gas in internal-furnace or gas engines. Gas can be transported with great convenience in pipes; and gas-engines require less attendance, and work with a greater temperature range and a higher thermal efficiency, than steam-engines. In transforming heat into work, small gas-engines are enormously more efficient than small non-condensing steam-engines. On the other hand, ordinary lighting gas, taxed as it is with costs of distribution due to its ordinary application for lighting purposes, is more expensive for a given calorific value than raw coal. The cost of ordinary lighting gas is increased, both by the need of a large generating plant, to meet the excessive fluctuation of the demand for lighting, and by the large distributing charges involved in supplying a very great number of small consumers. If gas were made specially for heating and power purposes—either coal gas of low luminous power, or water or producer gas—it could probably be distributed to power users at less than half the present price of coal gas. Used in gas-engines, it would then compete, on nearly equal terms, as regards cost, with solid coal, and would have many subordinate advantages. M. Aimé Witz has shown, by direct experiment, that a gas-engine worked with Dowson gas will give an effective horse power, at a total cost, including all charges for fuel, interest, and depreciation, not greater than that at which an effective horse power can be obtained by a good boiler and good compound steam-engine. It is impossible to predict how far gas-engines will replace steam-engines; but they have two disadvantages: They are more restricted in size than steam-engines; and they work less economically with light loads.

Professor Unwin next dealt with the production of power by burning town refuse—referring to what has been done in this matter by Professor Forbes, and by Mr. Watson at Oldham. He pointed out that the chief difficulty in using the available energy of destructors is that the refuse must be burned at a regular and almost uniform rate, while the demands for power vary. He then passed on to the question of generating power by steam; discussing at some length the conditions of economy and waste. He referred to the address delivered by Sir F. Bramwell to the Institution of Civil Engineers in 1885, in which were indicated the conditions involving waste of fuel in the production of steam power which are avoided by the working of central stations. He then showed, by means of tables, that, even under the favourable conditions of test trials, with constant and full load, the expenditure of coal and steam in non-condensing engines is 1·80 lbs. and 16·5 lbs. per indicated, and 2 lbs. and 18 lbs. per effective horse-power-hour; while for condensing engines the figures are 1·5 lbs. and 13·5 lbs. per indicated, and 1·75 lbs. and 15·8 lbs. per effective horse-power-hour. These may be regarded as minimum values, rarely surpassed by the most efficient machinery, and seldom reached except under the favourable conditions of a test trial. It is very difficult to get the consumption of coal by engines in daily work; but what is known shows that it is greater than in trials. Some comparatively large pumping-engines, which run with a steady load night and day, and which worked with 2 lbs. of coal per effective or pump horse power on a test trial, used 2·7 lbs. in ordinary working. The consumption was measured over many weeks, during which they were running 90 per cent. of the whole time. Here the consumption is 35 per cent. greater in ordinary work than in a test trial. If such a case as that of an electric lighting station is considered, where the load fluctuates very greatly—the maximum being often four times the mean, and the minimum 1·20th of the mean—the consumption per horse power is very much greater. Mr. Crompton has given the figures for the Kensington station, with Willans compound non-condensing engines. These will work with less than 2 lbs. of coal per effective horse power in trials at full load. Probably up to the present the consumption has in no case been less than 6 lbs. per unit generated; 3·8 lbs. per effective horse power, or 3·3 lbs. per indicated horse power. This large consumption is traceable to two classes of waste—engine and boiler waste—due both of them to the inefficiency caused by variation of load.

Dealing next with some of the causes of waste of heat in motors, the lecturer remarked that the principal one was essentially the same in both steam and gas engines, and was a consequence of the enclosure of the hot working fluid in conducting metallic walls. The evil could, he said, be diminished, but not entirely overcome, by the use of steam-jackets or by superheating. He then passed on to consider the question of "load factor," upon which the efficiency of engines depends; and he showed that the plant at a central station must be large enough for the maximum load. In illustration of this part of his subject, he exhibited three curves—one for a station of the London Hydraulic Supply Company, another for The Gaslight and Coke Company, and the third for the Kensington electric lighting station. In the first case, the demand for power water pumped by the engines was pretty constant from 9 a.m. to 5 p.m.; but, during the remaining hours, it was small. The load factor for the day indicated was 0·41 in 1887 and 0·46 in 1890, when the system had been considerably extended; showing that, as the number of consumers supplied was greater, the demand was more uniform. In the case of the Gas Company, the daily diagram factor, for a maximum of 10 million cubic feet of gas per hour, was 0·41 for a day in January; falling to 0·27 for a day in June, and rising to 0·52 for a foggy day in December. The daily load factor for the electrical station was 0·24 for the autumn, and 0·32 for the winter day. He next referred to the effect of mechanical efficiency and of back pressure on economy of working, and discussed the influence of the type of engine, the speed, and the mode of regulation on the thermal efficiency. Coming to the question of the variation of efficiency and fuel consumption in internal-furnace or explosion engines, he pointed out that gas and liquid fuel engines receive their charge at atmospheric pressure, as well as exhausting into the atmosphere. Hence, in a complete cycle, the resultant back-pressure loss is comparatively small. The engine friction, however, is rather larger than in steam-engines, and appears to be independent of the load. The mechanical efficiency therefore decreases at light loads, and the combustion is in some cases less perfect, or proceeds more slowly, and this is a cause of loss. Gas and petroleum engines should, he said, be run as far as possible at full load. At the Dessau electric station, which is worked with gas-engines, large secondary batteries are used to store the surplus energy when it is not required for supply, and to obviate the necessity for working the engines at light load. On the other hand, engines of this type have the very great advantage

that they can be started in a few minutes when required, and stopped whenever they are not wanted. In a station worked with such engines, there is no loss like that due to the irregular working of the boilers.

Professor Unwin proceeded to deal with the subject of the cost of steam power. In this connection, he gave the following figures as the cost of an effective horse power per year of (*a*) 1000 and (*b*) 3000 working hours respectively; the engine running regularly with nearly full load: (*a*) 1 h.p., £23·88; 10 h.p., £11·42; 50 h.p., £6·31; 200 h.p., £4·99. (*b*) 1 h·p., £38·64; 10 h.p., £20·71; 50 h.p., £10·23; 200 h.p., £7·61. These figures show a striking increase in the cost of working for small powers. It will be useful to place alongside these estimates of the cost of a steam horse power one of the cost of a horse power obtained from a gas-engine. For comparison, the very careful estimate of Professor Witz may be taken, based on experimental trials of an engine of 112 indicated horse power, or 77 effective horse power, worked with Dowson gas. The total cost of the engine, with pump and pipes, was £944, or £8·2 per indicated horse power. The gas generator cost £280, or £2·5 per indicated horse power. The foundations and erection (without buildings) cost £68, or £0·61 per indicated horse power. Thus the total cost without buildings was £11·5 per indicated, or £17·2 per effective horse power, or about equal to that of a steam-engine plant of the same power. Professor Witz takes the cost of anthracite at 25s. a ton, and coke at 28s. a ton. He allows for interest and depreciation 15 per cent. The gas consumption is taken at 84 cubic feet per effective horse-power-hour, which does not allow anything for irregular working. The figures (which are reduced to a year of 3000 working hours) are as follows: Interest and depreciation, at 15 per cent., £2·78; anthracite and coke, £2·36; petty stores, £0·40; wages, £0·96—total £6·5. The cost appears to be slightly less than that of a steam-engine of corresponding power; and it is equivalent to 0·51d. per effective horse-power-hour. The case of a central station worked by steam power differs from those previously considered, in consequence of the excess of plant required, and the waste due to working against a varying load. The annual cost of a horse power depends on the distribution throughout the day of the work to be done. If this is regular, and the engine works at nearly full load, the cost is comparatively small; on the other hand, if the work is very irregular, larger engines are required, the working is inefficient, and the cost is comparatively large. The lecturer took two cases to illustrate this part of his subject. The first was that of an engine working on a very regular load, under conditions similar to those of a motor pumping to a reservoir. Here the total annual cost for 7884 hours' work was put at £8·11, or equal to 0·24d. per effective horse-power-hour. The second was that of an engine working with very variable load—that is under conditions that would obtain in an electric light station. Here the total annual cost was put at £19·25, or equal to 0·51d. per effective horse power exerted, over the year.

Dealing further with the cost of a horse power at existing electric light stations, Professor Unwin closed his first lecture with the following remarks: It is perhaps, not entirely fair to take the cost of the working of electric lighting stations as a guide to the cost of steam power. They have been recently established; they work under difficult conditions; and the best methods of economizing cost have probably not yet been arrived at. On the other hand, they are central stations of the kind discussed in these lectures; and accounts of the cost of working are published in returns made to the Board of Trade. To be as fair as possible to electrical engineers, the case of Bradford may be taken, where, according to the returns, a unit of electricity supplied is generated more cheaply than at any other station. In dealing with the figures in the returns, the cost under the heading, "Salaries of manager, engineer, &c.," and that under the heading, "Redemption fund," are discarded. Further, half the cost under the headings, "Depreciation" and "Repairs and maintenance," is also subtracted, because under these headings are included charges not belonging to the cost of generating power. It would not make much difference if a larger or a smaller fraction had been subtracted. After making these deductions, the cost of a unit of electricity supplied at Bradford mainly, if not entirely, attributable to the cost of producing power is 2·1d. Now, the mechanical value of an electric unit is 1·34 horse-power-hours. Taking the average efficiency of the dynamo at 0·85, then one unit corresponds to 1·34 ÷ 0·85 = 1·57 effective horse power of the engine, Calculated on this basis, it appears that the cost of an effective horse power per year of 8760 hours, at Bradford, is £49. The cost of coal and petty stores alone, exclusive of all charges for labour, interest, and depreciation, is £14·6. At most other stations for which returns are made, the cost is considerably greater.

The other lectures will be noticed in subsequent issues.

A Gas Tramcar.—Last Wednesday afternoon, Major-General Hutchinson, R.E., visited Croydon for the purpose of inspecting, on behalf of the Board of Trade, a new tramcar, which is about to be used on the Croydon and Thornton Heath section of the Croydon and Norwood Tramways Company. It is known as the Lührig car; and it is propelled by means of gas. It is self-contained, and has a running capacity for about 15 miles. The motive power is furnished by two double-action 7-horse gas-engines, concealed at the back of the seats.

WATER ANALYSIS AND BACTERIOLOGY.

At the recent Meeting of the British Association at Nottingham, the above subjects came before the Chemical Section—the former, in a paper by Dr. S. RIDEAL, Lecturer on Chemistry at St. George's Hospital, and Mr. A. J. BOULT, on "The Application of Sodium Peroxide to Water Analysis;" and the latter, in one by Dr. PERCY F. FRANKLAND, F.R.S., Professor of Chemistry in the University of Dundee, on "The Present Position of Bacteriology."

The authors of the first-named paper began by saying that, now that sodium peroxide can be obtained commercially, its use in analysis seemed to be desirable. Hempel has already shown that it is a useful oxidizing agent for the detection of chromium and manganese, and that it forms a very convenient reagent for opening up tungsten minerals, and for effecting the decomposition of titanic iron ores. Since the commercial sodium peroxide is free from sulphur, it can also be used quantitatively for estimating the sulphur in sulphides. It occurred to the authors that an alkaline oxidizing agent of this character, if used, as a substitute for alkaline permanganate, in water analysis might throw some light upon the character of the organic nitrogen in waters. Hitherto other methods for determining the total nitrogen—*e.g.*, Frankland's and Djeldahl's, or Wanklyn's well-known process, in which only a portion of the nitrogen present in the organic matter is discovered—have been employed. In the latter process, very different quantities of ammonia are obtained from the various classes of nitrogenous organic bodies. Only when the nitrogen is present as some simple amido compound, like urea, aspartic acid, or leucine, does this process yield the whole of the nitrogen present. Preusse and Tiemann have shown, in their review of the processes for determining organic matter in water, that no reliance can be placed upon this one for estimating the absolute quantity of nitrogen in many substances, and that, therefore, when used as a method of water analysis, the quantities of ammonia obtained are only relatively true for waters of the same type. A comparison of the quantities of ammonia evolved from a water when treated with alkaline permanganate and with sodium peroxide might, therefore, possibly afford a means of differentiating the nitrogenous constituents. With this purpose in view, the authors compared in the ordinary course of analysis the amounts of ammonia given off under these two treatments. In one case, when using one gramme of sodium peroxide per half litre of water, the total ammonia evolved was equal to 0·027 part per 100,000 parts; while with alkaline permanganate, 0·050 part per 100,000 parts was obtained. On repeating this experiment with the same water and under similar conditions, 0·026 part per 100,000 parts was yielded by the peroxide, and 0·048 part by the permanganate. The addition of a further quantity of the sodium peroxide and further distilling did not increase the ammonia produced; and it was therefore evident that the sodium peroxide had failed to break down the organic nitrogenous substances present to the same extent as had the alkaline permanganate—in fact, the authors found it possible to obtain a fresh quantity of ammonia from a water after treatment with sodium peroxide by the addition of the alkaline permanganate. The following table gives the results obtained, in parts per 100,000, with four samples of water:—

Sample of Water.	Free Ammonia.	Peroxide.	Permanganate after Peroxide.	Free Ammonia.	Permanganate.
A . .	0·010 ..	Trace ..	0·007 ..	0·010 ..	0·008
B . .	0·001 ..	0·004 ..	0·011 ..	0·001 ..	0·013
C . .	0·012 ..	0·011 ..	0·015 ..	0·012 ..	0·027
D . .	0·021 ..	0·024 ..	0·057 ..	0·019 ..	0·078

From these figures (say the authors), it will be seen that the sodium peroxide in no case oxidizes the organic matter present to the same extent as does the permanganate. The peroxide seems to liberate a portion of the nitrogen which is included in that set free by the alkaline permanganate. As the total ammonia obtained by the action of the peroxide followed by permanganate is in most cases about equal to that obtained when the water is distilled with alkaline permanganate alone, there appears to be no ratio between the quantities of ammonia evolved by the two reagents; and therefore the nitrogenous organic matter present in water might be divided into two classes—viz., that which is oxidized by the sodium peroxide, and that which resists such treatment. The results obtained by Wanklyn's process as compared with the total nitrogen present in a water also show a differentiation in the organic nitrogen substances present in waters; but this knowledge has hitherto not been of any value owing to the complex nature of the problem. Further experiments can alone decide whether the limited oxidation of the nitrogenous matter in waters will throw any fresh light on the condition of these organic constituents of water. We have, however, noticed that in some cases a water which has been partially oxidized by the peroxide yields the remainder of its ammonia to the alkaline permanganate with much greater rapidity than when the water has not been so treated. We suggest that the explanation of this phenomenon may be due to the presence in waters of organic nitrogenous substances which when partially oxidized are then in a condition to be completely broken up by the stronger reagent. This result has been obtained with waters containing fresh sewage;

but we hope, by taking solutions containing nitrogenous compounds of known constitution, to confirm this suggestion, and trust thereby to show that in this reagent we have an oxidizing agent which will be useful in establishing the constitution of the nitrogen in complex organic substances.

Professor Frankland, in introducing the subject of his paper (which was of great length and comprehensiveness), said the present science of bacteriology really dated from the discovery, some twelve years ago, of methods for obtaining pure cultures. Since then the changes which have taken place have been chiefly in the methods employed for the recognition of bacteria. Microscopical characteristics, even when they have been brought out by mordant staining, have been found to be insufficient for this purpose. This was illustrated by the case of the cholera spirillum; as much difference existing between the different specimens of this spirillum, as between it and totally different species. Morphological have consequently been obliged to give way to chemical and physiological tests. Chemical tests, being as yet few in number, are apt to be treacherous; but they are capable of considerable extension. With regard to the chemical products of the action of organisms, the following questions suggest themselves: Does the same substance yield different products with different bacteria? Do the same bacteria give rise to the same products with different substances? Experiments with pure cultures have shown that one and the same bacillus will give identical products with such chemically related bodies as glycerol, arabinose, mannitol, &c. It appears probable that fermentability is due to the power possessed by a set of substances of yielding the same intermediate body which will give identical end products in all cases. The problems of selective fermentation were next dealt with, the cause of which was to be sought for in the slight differences of solubility, &c., shown by active substances, when in combination with optically active isomeric bodies.

Of great interest is what may be termed educational culture, by means of which new characteristics may be artificially impressed upon an organism. A species of bacillus, morphologically identical with anthrax, but totally incapable of producing spores, may be obtained by cultivation of true anthrax in broth containing certain salts, such as potassium dichromate, or nitrate. The new characteristics will even persist after passage through the bodies of animals. On the other hand, by various means the virulence of pathogenic organisms can be greatly increased, though it has not been found possible to produce pathogenic from non-pathogenic organisms. It becomes probable, therefore, that naturally occurring bacilli will acquire new characteristics according to alterations in their condition of growth. The occurrence of non-toxic associated with, and morphologically identical with, certain toxic organisms—*e.g.*, those of diphtheria, anthrax, cholera, and typhus—is suggestive in this connection. It is possible that ærobic organisms may become so far modified as to be active in absence of air. Much study is wanted in this direction, which affords special opportunities for observing the conditions of evolutions among simpler forms of life. The application of bacteriology to hygienic matters was next dealt with, with special reference to the bacteriological examination of water. Finally, the disinfecting action of light under different conditions was spoken of. The generation of hydrogen peroxide, from air and moisture, under the influence of light, discovered by Richardson, would seem to play an important part in this action of sunlight; and the problem partly resolves itself into the study of the conditions of formation of this substance. The effect of different salts in modifying the bactericidal effects of sunlight was touched upon; and, in conclusion, the need was urged upon chemists of a knowledge of biology and botany, to enable them to carry on bacteriological work, for which the first necessity has now become profound knowledge of chemistry and chemical methods.

An Improved System of Smelting Steel by Oil Gas.—Mr. T. V. Lloyd, of Cardiff, has called our attention to a producer he has invented for manufacturing gas from crude oil for heating open-hearth steel furnaces. The apparatus consists of four square retorts, 2 feet by 2 feet inside, and 6 feet long, set vertically between the regenerators and the chimney, so that the waste heat, after passing through the checker-work, heats the retorts. Dampers are arranged to allow the air, which is reversed every half hour, to pass through the checkers, instead of being transmitted from the flues of the retorts; thus avoiding destruction and cooling of the apparatus. The retorts are filled in with checker-work (1½ splits set on edge), and are fitted with top and bottom mouthpieces. The oil is admitted through the top cover into a brick tube, 3 inches in diameter, formed in the centre of the retort. A small jet of steam is sent into the same chamber, to force the oil to the bottom of the producer. The bottom mouthpiece is fitted with a perforated lid, placed inside the cover, for distributing superheated steam. The oil is decomposed as it goes through the checker-work. The hydrocarbons are then drawn off by an exhauster, passed to a governor, and then to the furnace, at the neck of which the gas is admitted. The apparatus is so arranged that the retorts can be heated by oil to generate gas for starting a new furnace. The producer is entirely in charge of the lever man; and all the dampers and valves of the furnace and producer are worked from an elevated platform.

REGISTER OF PATENTS.

Automatic Prepayment Sale and Delivery Attachments for Gas and Liquid Meters.—Brownhill, R. W., of Aston, near Birmingham. No. 13,181; July 19, 1892.

This is an improvement upon patents No. 7012 of 1887, No. 6537 of 1888, and No. 20,583 of 1889. It consists in means for changing the quantity of gas to be delivered in exchange for a standard coin (consequent upon the rise or fall in the price of gas), without interfering with the mechanism of the attachment, or opening the meter, as in the case with attachments of the former construction.

Thus, according to one part of the present invention, a quantity of gas, *pro ratâ* with the prevailing price, is regulated to be delivered. Another part consists in means for giving a slight independent movement to the coin-lever (prior to its active movement), for the purpose of releasing the coin deposited in prepayment. A further part consists in the working of the transmitting mechanism, and in gear and means for transmitting motion to the notch disc—whose retrograde movement, driven by the meter, determines the consumption of gas—by an arm of a valve.

In carrying out one form of the invention, there is fitted within a framing, a fixed and slotted quadrant bracket, having rack-like teeth, with which a pinion, made fast upon an axis turning within fixed bearings, engages. This axis has a quantity-wheel made fast to it, with twenty or other suitable number of notches cut within it. With one or other of these notches, a combined pointer and spring-stud engages, and fixes to a determinate degree the traversing space of the slot. Within the slot, a stud or block, carried by an arm, traverses; and by the motion made by the arm, more or less teeth of a ratchet-wheel are thereby comprehended. Thus, each tooth of the ratchet-wheel indicates a certain quantity of gas; so that, by the lever being made to describe an arc covering a certain distance, a certain quantity of gas is allowed to be delivered.

The quantity-wheel, by being rotated, communicates motion to the pinion, and through the pinion slides the bracket; so that the traverse of the arm shall be more or less, according to the price of gas. The stud or lever, which moves within the slot of the bracket, turns loose upon an axis, which has loosely mounted upon it a ratchet-wheel; and carried by the lever (which has a gap or slot upon its inner side) are two pawls. These alternately engage with a tooth of the ratchet-wheel, which, in the present instance, comprehends 120 teeth, which are equivalent to 240 with a single pawl. Loosely mounted upon the same axis as the ratchet-wheel and pawl-carrying lever, is a coin-lever rocking-arm, with a stud near its upper end, and with a coin-lever turning near its middle upon a pivot centre. This rocking-arm also has upon one side a snug, or an anti-friction wheel, against which an arm of the operating handle comes, on the whole of the mechanism being turned back. At the back of the ratchet-wheel is a clutch; while jointed and mounted below the axis is the operating handle, with the aforesaid arm, having a stud at its outer end, which is adapted to engage with an upwardly directed hooked end of the fore part of the coin-lever, while the bifurcated portion of the fore part of the coin-lever comes under the shoot of the coin-slot. This mouth is inverted, and the throat tortuous, and provided with hanging pawls, for preventing fraud.

The ratchet-wheel face has a bevel-wheel upon it, which gears with a bevel pinion, carried by a frame bracket made fast on the principal axis. The bevel pinion intergears with the teeth of a second bevel-wheel, carrying a notched disc, loose on the axis, and with a sleeve connected with the notched disc—terminated by a pointer, adapted to come in front of a dial. Thus the notched wheel, second bevel-wheel, and the indicating finger move together; while the bevel pinion, which is made fast with the axis, makes a "sun-and-planet" movement, in communicating motion from the ratchet-wheel bevel-wheel, to the notched disc bevel-wheel.

Coming upon the periphery of the notched disc is a pawl-acting arm, with a hooked or detent outer end, adapted to take within the notch; while the other and inner end carries the valve, or influences the movement of the valve, which works within a box in communication with the gas supply. Made fast upon the main axis, which carries the bevel pinion bracket is a tangent wheel, with which a worm engages; while on the axis of the worm is a tangent wheel, with which a worm on the drum axis engages.

By placing a coin up the coin-slot, and then letting it roll down its shoot, and rest upon the forked end of a counterpoised coin-lever, the hooked end of the lever is caused to become approximate to a stud of the arm of the operating handle (which is worked from the outside). By now pulling the operating handle upwards, the stud of its cranked arm takes under the hooked end of the coin-lever; and, by the quadrant movement made by the cranked arm, the lever is made to traverse forward, so as to bring the forked end clear of the outlet of the coin-slot. The coin then falls. The forward movement of the coin-lever takes place prior to the communication of any motion to the ratchet lever or pawls. The now continued movement of the operating handle brings the stud of the rocking-arm against a front shoulder of the slot of the pawl-carrying lever, so that the coin-lever, rocking-arm, and pawl-carrying lever or arm move together, until the stud of the latter has passed to the end of the slot of the fixed bracket. The pawls, during this movement, have wiped over the teeth of the ratchet; and one of them is engaged with a tooth. By now pressing the operating and outside handle in the reverse direction, the stud of its cranked end has been taken from the hooked end of the coin-lever; and the extreme fore part of the arm is brought against a lug or roller on the rocking-arm. On the stud coming against the left-hand shoulder of the pawl-carrying lever, the ratchet-wheel is moved round a distance proportionate to the traverse allowed in the fixed bracket.

The moving from right to left of the ratchet-wheel causes its bevel-wheel to rotate the bevel pinion, and give a reverse rotation to the bevel-wheel on the notched disc. The notched disc, with the finger, is thus moved in a contrary direction to the ratchet-wheel; and the hooked end of the pawl arm is automatically lifted from the notch, and made to rest upon the circumference of the disc.

The lifting of the pawl arm from out of the notch opens the valve, and allows gas to flow directly from the drum of the meter. Its axis

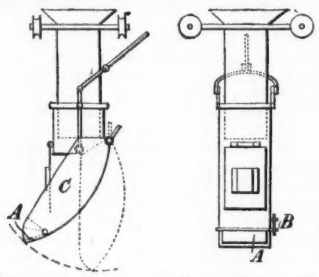
now rotates and communicates motion to the worm, and from the worm to the worm pinion and axis, and from thence to the second worm, and to the wheel which turns the main axis of the mechanism of the attachment, and through which axis motion is communicated to the ratchet-wheel, and, by its bevel-wheel, to the bevel pinion, and from thence to the disc bevel-wheel and finger sleeve, which latter are now turned from right to left, and are turned back *pro ratâ* to the consumption of gas.

When the notch comes coincident with the detent end of the pawl arm of the valve, the end falls, and cuts off the supply of gas. When gas is being delivered, the bell-cranked end presses upon the plain periphery of the disc; and by its means closes the slot against the introduction of fresh coins. The back movement of the notched disc is performed through the intervention of the bevel pinions, receiving their movements from the drum axis.

On the price of gas changing, the quantity-wheel is simply rotated to a position indicative of a certain quantity for a fixed sum; and it is there affixed by a catch or other arrangement. The adjustment of the quantity-wheel determines the space through which the arm and ratchet-wheel can possibly move. The adjusted traverse of the arm can then only give out an adjusted quantity in exchange for a standard coin. By the traverse being extended or curtailed, so the quantity of gas (according to the prevailing price) is adjusted.

Charging Inclined Gas-Retorts.—Van Vestraut, L., of Leadenhall Street, E.C. No. 20,710; Nov. 16, 1892.

This apparatus, for controlling the charge of material in inclined retorts, consists of an adjustable stop-plate A of metal—of variable sections or shapes, as necessity arises—placed at the bottom of the shoepiece C of a charger, and removable and adjustable at will, and changeable to the required section or mouth of retort.

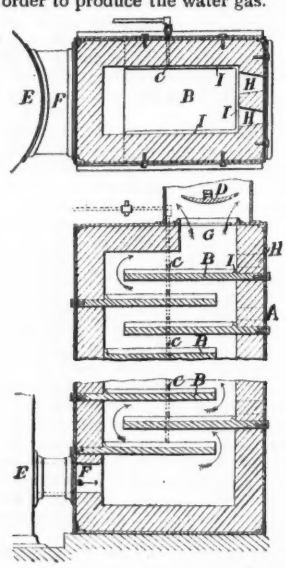


In charging sloping retorts, says the patentee, the mouthpiece is sometimes encrusted with carbonized materials, which interfere with the perfect delivery of the charge of coal; and this has to be cleaned off before charging the coal. Again, the charging material may be of lumps, which require a slight check, in order to evenly distribute the material over the floor of the retort. This adjustable check-plate A is hung at one end on pivots B, and is operated by raising or lowering the free end, to ensure the even delivery of material.

The apparatus is inserted in the mouthpiece on the floor of the retort; and it allows "the perfect flow of coal as arranged by the position of the adjustable check, and is removed with or without the charger, and the door closed as usual."

Gas-Producers.—Sutherland, W. S., of Edgbaston, Birmingham. No. 21,028; Nov. 19, 1892.

This invention is more particularly intended for application to water gas producers; the object being to dispense with the steam-boilers at present required to generate steam to be passed through the incandescent fuel, in order to produce the water gas.



The water-evaporating chamber or attachment A is preferably made of boiler-plate, with a fire-brick lining, so combined with a gas-producer E that the waste heat from the producer heats evaporating surfaces in the interior of A; and when the steam current is required, water or water and steam placed on these surfaces is evaporated, and passes to the gas-producer under slight pressure. When applied to a water-gas apparatus, the gases leaving the regenerator pass, during the "blowing-up" process, by way of the passage F through the interior of A, containing a number of metallic troughs or shallow trays as B, arranged one above the other, so as to cause the gases to pursue a zig-zag path before passing out of the chamber. The gases, after leaving the regenerator, are still at a comparatively high temperature; and so they heat the interior of A, together with the metallic troughs, trays, or other surfaces before discharging through a valve D. When the blowing process is complete, the air-blast is stopped; and the discharge-valve D from the chamber A is closed. Water is then pumped upon the upper trough or surface B within the chamber; and it partly evaporates to form steam, while the excess water drains from the first to the second trough, and from the second to the third, and so on, through the series. Perforations in the troughs cause the water to drain over as much surface as possible before passing to the next plate; and in this manner steam is quickly formed, and superheated to some extent before it leaves the evaporating chamber. From the evaporating chamber, the steam passes, by way of the passage F, through the regenerator E, and thence to the producer, where it is decomposed, after being highly heated by the regenerator surfaces.

The interior of the evaporating chamber is either brick-lined, as shown, or entirely metallic. In the event of using brick-lining, the trough baffle-plates are so arranged as to prevent water coming into contact with the brick, by ledges I.

Sometimes water is pumped on each plate or trough (in order to hasten the evaporating action), by means of pipes C. The apertures H are merely sight-holes.

Manufacture of Illuminating Gas.—Paterson, R. O., of Cheltenham. No. 21,649; Nov. 26, 1892.

This invention has for its object "to carry on the manufacture of gas for illuminating or other purposes, in such a manner that an increased yield of gas is obtained from a given quantity of coal or the like, by causing the condensed or liquid products which separate from the gas to pass back into, or circulate through, the retort or retorts until the products become converted, or in great part converted, into gas." The patentee says he is aware that attempts have before been made to return such condensed or liquid products to a retort by the same passages or pipes as those through which the gas passes from the retort; but this plan was not found to be practicable, as, owing to the intense heat in these passages or pipes, the products become carbonized in them, and do not, or in great part do not, return to the retort. Furthermore, when so carbonized, they eventually choke or obstruct the passages or pipes.

According to the present invention, provision is made for the return of the condensed or liquid products back to the retort by means of a separate pipe or passage (that is, one distinct from that through which the gas passes from the retort) not subjected to high temperature, and which leads from a part of the ascension-pipe, or from a receptacle into which it opens, wherein the condensed or liquid products are deposited, back to, or near to, the end of the retort opposite to the end from which the gas is drawn off.

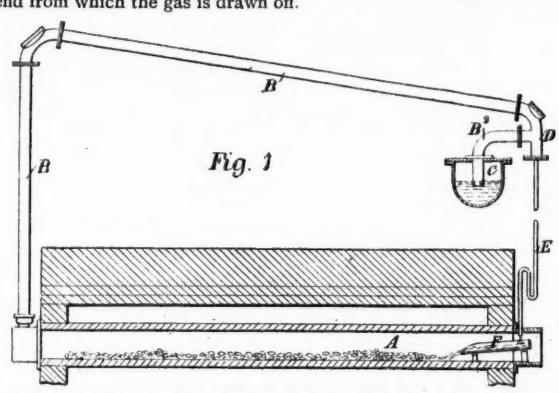


Fig. 1

Fig. 1 is a longitudinal section of a horizontal, or approximately horizontal, retort—showing an arrangement according to this invention applied thereto.

A is the retort; the ascension-pipe B by which the gas passes therefrom being inclined downwards towards the opposite end of the retort, where it communicates with a pipe leading to the hydraulic main C, or receiving or foul main. The lower end of the pipe B forms a well D, in which condensed or liquid products deposit, and from which they pass, by another pipe E leading from this well, into the rear end of the retort, so that the condensed or liquid products re-enter the retort by this pipe, to be subjected to the heat of the retort. Thus the products circulate through the retort until they are wholly (or in great part) gasified. The bottom of the rear end of the retort may be inclined upwards, so as to facilitate the flow of the products into the retort; and the retort may be provided with an inclined trough, on to which the products are received and directed into the retort. Or the ascension-pipe B may be led downwards into a chamber D, as shown in fig. 2, in which chamber the condensed or liquid products are deposited, and are conducted therefrom by the pipe E back into the retort. The pipe E should have a bend in it, to constitute a seal, in order to prevent the passage thereinto of gas from the retort. The gas which enters the chamber D passes out by the pipe which opens into the chamber above the liquid therein, and leads to the hydraulic main C.

If it be desired to prevent ammoniacal liquor from passing back into the retort with the other condensed or liquid products, the chamber may be made so that it constitutes a separator for the ammoniacal liquor from the other liquid or tarry products. This can be accomplished by furnishing the chamber with a partition (fig. 2), descending from the top of the chamber to below the level of the tarry products; the gas passing into one of the compartments thus formed, and therefrom to the hydraulic main or receiving or foul

main. The condensed or liquid products deposit in the lower part of this compartment; the ammoniacal liquor being prevented by the partition from passing into the second compartment. But the tarry products which are lowermost pass into this second compartment, by an opening beneath the partition, and pass back to the retort by the pipe E, which opens into the second compartment. There should be an aperture in the upper part of the partition, so as to equalize the pressure in the two compartments. There may be a bye-pass pipe, provided with a stopcock, and leading from the first compartment into the pipe E, which conducts the tarry products back into the retort. In this way, when it is desired that all the condensed and deposited products (including the ammoniacal liquor) shall pass back to the retort, this can be effected by opening the cock on the bye-pass pipe.

Although the application of the invention has been described to horizontal retorts, it will be readily understood that it is applicable also to inclined or vertical retorts.

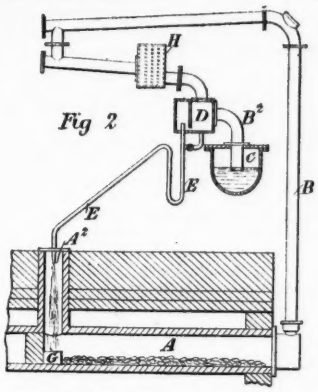


Fig 2

In fig. 2, G represents a fire-clay block, on which the liquid products fall; but they may fall on the heated bottom of the retort, or upon the coal therein. In order to acilitate the separation of the liquid products from the gas, the ascension-pipe is preferably made as high as is convenient, so as to get as extended a cooling surface as possible; the extension of the pipe across the bench also assisting in this respect. This can be further facilitated by jacketing the pipe, and causing water to flow through the jacket; or a separator may, if desired, be arranged in the pipe—consisting of a chamber containing perforated plates, against which the gas impinges, and through which it passes, as shown in fig. 2 at H.

In fig. 1, the pipe E is shown as leading directly into the retort; while in fig. 2 it opens into an extension from the retort.

The claims for this invention are: (1) In the manufacture of gas for illuminating purposes, the return of condensed or liquid products deposited from the gas back into the retort (at or near the end opposite to that at which the gas is drawn off), by a pipe or passage which is distinct from that through which the gas passes from the retort. (2) The combination with the ascension-pipe, or passage through which the gas passes from the retort to the main, of a pipe or passage into which the condensed or liquid matter deposited from the gas is received and conducted back into the retort, at or near the end opposite to that at which the gas is drawn off. (3) The combination with the ascension-pipe or passage through which the gas passes from the retort to the main of a separator, into which the condensed or liquid matter deposited from the gas is received, and a pipe or passage for leading therefrom back to, or near the opposite end of the retort, the liquid or tarry products from which the ammoniacal liquors have been separated.

APPLICATIONS FOR LETTERS PATENT.

18,743.—SMETHURST, W., VICKERS, W. E., and ROGERS, G. R., "Burners and apparatus for utilizing the heat obtained by the combustion of an intimate mixture of air with gas or inflammable vapour." Oct. 6.

18,913.—ZIMER, F. W., "Gas-heaters." Oct. 9.

19,007.—BERGFELD, R., "Gas-stoves." Oct. 10.

19,161.—HARTLEY, J. W., "Gas-making apparatus." Oct. 12.

19,185.—PSAROUDAKI, S., and BLONDEL, A., "Diffusion and distribution of light." Oct. 12.

19,316.—LYST, F., "Metallic gas-drying chamber for equalizing gas pressure, to be used in supplying gas to engines, and for other gas supplies." Oct. 14.

19,327.—GRAHAM, J. C., "Superheater, gas generator, disperser, and burners, for using crude or other oils as fuel." Oct. 14.

19,334.—CHESTER, W. R., "Instrument for automatically recording pressure or vacuum of gaseous bodies contained in closed vessels." Oct. 14.

New Pumping-Engine for the Ipswich Water-Works.—The Ipswich Corporation have accepted a tender submitted by Messrs. J. Simpson and Co. for the supply of a compound three-cylinder Worthington surface condensing engine for £2600. This engine is to replace an old one; and the expenditure was contemplated throughout the negotiations for the purchase of the works.

South African Gas Company, Limited.—The voluntary liquidation of this Company was finally closed at the meeting of shareholders held on the 17th inst., when the accounts of the Liquidator (Mr. S. Wood, of Messrs. Alfred Lass, Wood, and Co.) were adopted. The shareholders have received Cape Town gas shares of the nominal value of 6s. 8d. in the pound, and cash to the extent of 1s. 7½d. per share. A cordial vote of thanks was passed to the Liquidator for the care and economy he had exercised in carrying the liquidation through exceedingly complicated and adverse circumstances.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by correspondents.*]

Hislop's Regenerative Retort-Settings.

SIR,—After reading your report of the discussion on the above subject at Middlesbrough, I would seek, with your permission—not in a boastful spirit, but in justice to Mr. Hislop—to give the results obtained here with his settings. We had erected, at a total cost of £527 11s. 9d., three ovens of six retorts each. At the present time, I have working two ovens—in all, 12 retorts—and the make of gas from these is from 112,000 to 116,000 cubic feet per 24 hours. It will thus be seen that we get about 9500 cubic feet per mouthpiece per 24 hours. Our retorts measure 21 in. by 15 in. by 9 ft., all inside measurements. The coal we use is Imperial Long-Spiked Arley; and it is charged every four hours. The manufacturing expenses are only 1·5d. per 1000 cubic feet of gas made. There are four stokers, who wheel the coal, charge the retorts, and wheel out the coke. With larger retorts, to hold more coal, such as those in use at Cockermouth, and well packed, the result would be much higher. The cause of the small yield given by Mr. Smith is due to the fact that only 2½ cwt. charges were put in; while the retorts could work off quite readily 1 cwt. more.

Dundalk, Oct. 20, 1893. G. R. LOVE.

MISCELLANEOUS NEWS.

THE CRISIS IN THE COAL TRADE.

When referring to the above matter in our editorial columns last week, we ventured to intimate that the great coal war was "nearing the end." Unfortunately, the end has not yet been reached; and therefore we have to continue our chronicle of the most noteworthy events in the struggle.

The past week opened with a resumption of work at the old rates at the Pentrich pits, near Ripley, in Derbyshire, and at the Awsworth Colliery, near Ilkeston. It was thought that the coalowners in many parts of West Yorkshire were likely to give way soon, and re-open their pits; and one firm—the Morley Main Company—had already done so. Some of the pits were thrown open at the reduction; but the men remained firm, and none resumed work. In certain cases, an intimation was posted that, unless the terms were accepted, the pits would be closed for the remainder of the year. About 10,000 miners in the Leicestershire and South Derbyshire coal-fields returned to work; and the brickyards and tile works, which had been stopped in consequence of the scarcity of fuel, were expected to be in full operation in the course of a few days. In the Manchester district, a number of important pits, including those of the Bridgwater Trustees, were formally thrown open on the federated owners' modified terms of 15 per cent. reduction; but, as had been generally expected, none of the miners presented themselves. In the Accrington district, not a single miner responded to the invitation given by the employers to resume work on the modified terms; the workmen having held a meeting and unanimously decided to decline the offer—in fact, they seemed more determined than ever. In the Wigan and St. Helens districts, the colliers likewise rejected the masters' offer. Serious rioting occurred at Ince, near Wigan, as the result of reports that men were getting coal. Several persons were more or less injured; and much damage was done to property. At the Grimsby Town Hall, the Mayor of Grimsby (Mr. Alderman Doughty), head of the coal trading firm of Messrs. Doughty and Hagerup, delivered an address to a crowded audience upon "The Coal Strike, and the Lessons it should Teach." He gave statistics of the enormous loss which the strike had already caused, and stated that to the fishing trade of Grimsby alone it amounted to £1000 per week. He deprecated the action of the colliery owners in asking for a 25 per cent. reduction in wages, and said they had since entirely changed their ground. It was a misfortune that the Government, before they adjourned, did not devise a scheme to meet with those concerned to discuss the situation. He favoured the establishment of Boards of Conciliation, profit-sharing, and co-operation in large concerns as well as in small. He thought the time had come when it would be better if such big fortunes were not made, and the money more equally and reasonably divided among the people all round. He was excessively grieved that this country was made the labour battle-ground; for trade was being lost and money going to other parts of the world which ought to be expended here. It was not so much a question of armies and navies as of the industries of a country; and he sincerely trusted this fact would be recognized by all, and this labour warfare cease. These remarks were received with loud cheers. On account of the continued mildness of the weather, coal merchants in London experienced on Monday a very slow demand from the public, even at the reduced prices of the previous Friday; and, being anxious to stimulate trade, in order to make employment for their waggons and horses, it was decided, after considerable discussion, to further reduce public prices by 2s. per ton for best house coal, and 1s. per ton on the other qualities. Best Wallsends would, therefore, be quoted at 28s. per ton; kitchen, at 26s.; and cobbles and nuts, at 25s. On the other hand, factors were very firm; considering that any further giving way was not justified in the face of the continued steady demand for steam coal and the increased consumption of gas qualities—in fact, prices for these having advanced by 2s. per ton at Newcastle since the previous Friday, it was contended that an advance rather ought to have been made.

On Tuesday there was a further resumption of work at the old rate of pay. On the other hand, the coalowners' offer of 15 per cent. reduction was firmly refused in many places. The coal strike at St. Helens culminated in serious rioting. A meeting of some thousands of miners was held at Ashton Green, near the collieries belonging to

Bromilow, Foster, and Co., and it was stated that several men were working down the pit; but Mr. T. Glover, J.P., miners' agent, said there were only eight men and two boys engaged clearing out water. He earnestly appealed to the men to refrain from committing a breach of the peace; and a resolution was unanimously carried to remain out on strike, unless the masters conceded the old rate of wages. After the meeting, a great crowd of people invaded the colliery yard, and attacked the men leaving the pit. A force of police was called in, and a conflict ensued, in which serious injuries were sustained. In the Leigh district, a restless spirit was manifest; and the police had to be called out. Questions arose on Tuesday as to the position of coal contractors in the present crisis. At a meeting of the Liverpool Water Committee, it was stated that a deputation of the Wigton and Whiston Coal Company had waited upon them, in order to endeavour to obtain a higher price for coal. The deputation stated that the Company had already lost £500 under the contract. The Committee declined to make any advance, and pointed out that the Company had no alternative but to go on supplying the coal—there being no strike clause in the contract. The coal contractor to the Colchester Board of Guardians having requested the Board to allow a variation of the contract, and pointed out that, owing to the lock-out, coal was selling at 38s. which he had to supply at 14s. 10d., the Guardians wrote to the Local Government Board, asking if they could legally pay a contractor more than the contract price. The reply was that it did not appear that the Guardians could legally do so; but that there were certain provisions for terminating contracts. It was decided to forward a copy of the letter to the contractor.

A meeting of coalowners was held on Wednesday, in Manchester, to consider a letter from the Secretary of the Lancashire and Cheshire Miners' Federation upon the present dispute. Mr. A. M. Chambers presided. There were present owners representing pits yielding 50,000,000 tons of coal out of 80,000,000 tons annually produced by members of the Coalowners' Federation. The letter was accompanied by a copy of a resolution passed at the miners' conference at Birmingham, agreeing to resume work on the old terms, and also re-affirming the resolution passed at Chesterfield to accept the old rate as the normal condition of wages. The conference, after considerable deliberation, unanimously resolved as follows:—

(1) The coalowners, though willing to meet the men in endeavouring to find a reasonable method of bringing the present disastrous dispute to a close, regret that the proposal contained in the men's resolution cannot be accepted.

(2) That the coalowners again repeat and confirm the resolution at Derby, that the men may resume work at 15 per cent. reduction off the advances given.

(3) The owners are further prepared to agree that this reduction shall not be taken by either side as a final settlement of the dispute, but as a means of removing the present deadlock; and they are quite willing to submit the whole question of reduction or no reduction to a Committee formed of equal numbers of coalowners' representatives and workmen's representatives with an independent chairman.

(4) That the coalowners' Executive Committee is empowered to meet the men's Committee to discuss the above resolutions, whenever the latter is invested with power to deal with them.

(5) That a copy of the foregoing resolutions be forwarded to Mr. Ashton, Secretary of the Miners' Federation, and to the Press.

Mr. T. R. Gainsford, the Managing-Director of the Sheffield Coal Company, which employs 2300 men at the Birley pits, near Sheffield, announced on Wednesday evening that he would re-open the pits in the morning on the old terms. This was the first serious defection in South Yorkshire; and it was thought it might have an important effect upon the district. Mr. Gainsford stated that, in his opinion, the owners made a fatal mistake at Derby in not agreeing to the terms of the six Mayors. He did not think these were adequate; but, under the circumstances, they represented a fair compromise, and should have been accepted. He thought the best plan now was for the owners to adopt the proposals of the Miners' Federation, and immediately afterwards form a Board of Conciliation, which might be made very valuable. If both sides entered upon it in the right spirit, there were immense probabilities of good to be anticipated from it. Further rioting took place on Wednesday. At Messrs. R. Evans and Co.'s collieries at Haydock, there was a serious affray; and both rioters and constables received injuries. All was quiet, however, at the Ashton Green Colliery. On the London Coal Exchange, the demand was more active; and prices in several directions were stiffer. Merchants, however, stated that trade with the householder had been little stimulated by the reductions of the previous Friday and Monday; and therefore the buying might be attributed more to an anticipation of the larger trade which must result from colder weather than any material improvement in the demand from the public at present. Nevertheless, there was a very keen inquiry for coal for gas-making purposes; those Companies which have contracts running with the Yorkshire collieries having to come on the market for their requirements. Factors generally expressed the opinion that the strike in Yorkshire and Lancashire would be prolonged for some time; and, in consequence of the increased demand, they were very firm—seaborne coal being raised 1s. to the merchants. To the public, however, it was decided, after a prolonged meeting of merchants, not to advance prices. The quantity of Welsh steam coal offering was very moderate; and rates, if anything, were firmer—up to 19s. being quoted for best into barge. For gas coals, 14s. 6d., *ex* collier in the Thames, was easily made; and rough small also met with a very ready sale at 12s. 6d. into barge for Durham sorts, and 9s. 6d. for Newcastle.

A general meeting of the Cannock Chase and District Coalowners' Association was held at the Great Western Hotel, Birmingham, on Thursday, to consider the resolution adopted by the coalowners at Manchester on the previous day; and it was unanimously approved. Determination was also expressed to insist upon a reduction or a reference to conciliation. It is calculated that the Cannock Chase men alone have lost about £170,000 in wages since the beginning of the strike. The masters' loss of profits during the same period is roughly estimated at one-tenth of this amount. The officials of the Miners' Federation at Manchester announced that no meeting of their Executive Committee would be called to consider the resolutions passed by the coalowners, as they would discuss no proposals involving a resumption of work at a reduced rate of wages. The Directors of Messrs. Cross, Tetley, and Co., at Bamfurlong, decided to re-open their colliery at the old rate; and the Birley pits of the Sheffield Coal Company were started again under the same conditions. A prominent South Yorkshire coalowner, who is also largely connected with pits in other parts of the country, expressed his conviction that the owners had seen the last of the defections from their ranks. No surprise, he said, was caused to the general body of owners by the action of any of those who had given way, as they were all known to be weak; and their defection was calculated upon before the Federation decided to enter upon the struggle.

Last Friday, arrangements were made for convening a meeting of the Lancashire Miners' Federation to consider whether a basis of settlement could not be formulated; it being understood that Mr. Aspinall, miners' agent, Wigan, had a proposal to make. There was a growing feeling among the miners that the employers would accept a proposal which would make it appear that neither side had obtained a victory. Telegrams reached Mr. Ashton, Secretary of the Miners' Federation, that the men employed at the Astley and Dunkirk pits, Dukinfield, and at the pits in Hyde and Broomstairs respectively, all owned by Mr. Boyd, had received permission to return to work at the old rate of wages. Mr. Boyd is one of the employers who met the miners' representatives before the stoppage began, when it was sought to prevail upon the masters to withdraw the notices of a 25 per cent. reduction. At the four pits named there are in the aggregate between 800 and 1000 men employed. Announcements were made that the Scot Lane Collieries, at Wigan, were to be opened at the old rates; and that the Worthington Collieries, Standish, would start on the 23rd and work double shifts. Other firms were expected to take this course at the beginning of the present week. Three collieries belonging to the Dukinfield Coal and Cannel Company were opened at the old rate of wages, pending a settlement between the two Federations. The firm employ 1800 men and boys; and the majority of these resumed work. A partner in one of the largest colliery firms affected by the strike, and a member of the Coalowners' Committee, who attended the meeting of the owners at Manchester on Wednesday, stated that a wrong impression prevailed with regard to the proceedings of the Committee, and misstatements had been made. The view taken by the coalowners was that, while they refused to allow men to return to work on terms existing previous to the stoppage, the men on their part would decline to resume work at 15 per cent. reduction. In order to get rid of the deadlock thus occasioned, the owners passed resolutions to meet the men in the manner suggested in the third and fourth clauses. He said: "We proposed to admit that the reduction should not be taken by either side as a final settlement of the dispute, but as a means of removing the present deadlock; and we are quite willing to submit the whole question of a reduction or no reduction to a Committee formed of equal numbers of coalowners' representatives and workmen's representatives, with an independent chairman. It is not true that the owners make it a condition that the men return to work at a 15 per cent. reduction before this meeting can take place." An attempt was made early on Friday morning to blow up the house of Mr. J. Harrison, a foreman at Ashton's Green Colliery, where the riots took place on Tuesday. The explosion shook the whole house and broke the glass; but fortunately none of the family were injured. On the London Coal Exchange, there were a large number of buyers; and there was an active demand for coal throughout the day. Supplies of all descriptions being short, the tone of the market was strong; and the official quotations for seaborne house coal were advanced another 1s. 6d. per ton. Hetton Wallsend and Tees sold at 24s., East Hartlepool at 23s. 6d., and Hetton Lyons, Whitburn, and Eden Main at 23s. in the pool, and less the usual discounts. As soon as this was announced, merchants held a meeting to fix public prices, and agreed to advance Wallsend 4s. per ton to 32s., and other sorts 3s per ton. Good house coal was quoted at 30s., kitchen at 29s., and cobbles and nuts at 28s. per ton. To the dealers, also, prices were put up 3s., and coal sold by the hundredweight was charged 1s. 8d.—an advance of 2d.; but coke was unchanged at 15s. per 12 sacks.

The representatives of the Lothian miners met on Saturday, and decided to reject the masters' proposal for arbitration on the wages question. They also resolved that, except where the men are working at the 10 per cent. advance, only four days a week shall be worked. A ballot taken among the Durham miners, the result of which was declared on Saturday, shows a large majority in favour of accepting the owners' offer of a 5 per cent. advance for three months.

With daily increasing requirements and steadily diminishing stocks which are not easily replenished, the position of many gas-works is becoming increasingly difficult. Burnley was on Saturday week so short of gas that the pressure could not be maintained; and part of the town was in darkness, while the rest was very indifferently supplied. Other Lancashire and Yorkshire towns, which are chiefly dependent on the Wigan and South Yorkshire coal-fields for their supplies, are in similar straits. At Oldham, on Wednesday, the Gas Manager (Mr. J. Chadwick) pointed out to the Gas Committee that it would be necessary to provide for a consumption of 3000 tons per week until Christmas; and that if the miners did not return to work there would be more difficulty in getting it later on. The Superintendent of the Gas and Water Departments (Mr. H. Andrew) also reported on the subject. He stated that the great increase in the price of coal over the contract figures, after making allowance for the additional revenue for coke at the present price of 15s. per ton, would amount to about 1s. 1½d. per 1000 cubic feet of gas sold. The quantity sold during the quarter ending December, 1891, was 305 million cubic feet; and if the present prices ruled till Christmas, the difference to the Gas Department, on such a consumption, would be equal to about £17,156. Mr. Andrew pointed out that, unless some change were made in the price charged for gas, there would be a very heavy loss indeed on the year's transactions. Mr. Chadwick stated that the stock of coal consisted of 8000 tons, and that there was not the slightest probability of any of the collieries with whom they had contracts giving way. It was decided to purchase 2000 tons of coal offered at the rate of 26s. 6d. per ton. The question of advancing the price of gas was discussed; but was ultimately adjourned. The Watch Committee were asked to exercise as much

economy as possible in connection with street lighting. In consequence of the necessity to purchase coal at increased rates, the Directors of the Sheffield Gas Company, as stated elsewhere, have decided to raise the price of gas 3d. per 1000 cubic feet.

The Press Association gave publicity last week to the following communication, received from the Chairman of one of the largest collieries in Yorkshire, respecting the actual earnings of miners: "From day to day the miners' leaders make statements, either at meetings of their constituents or in the papers. For the most part, these statements are left uncontradicted by the coalowners, and the public are therefore liable to take it for granted that, since they are not contradicted, their accuracy is admitted by the employers. This is very far from being the case; and no doubt the public have been much misled by the supineness of the coalowners as to stating their case. Mr. Woods talked the other day about colliers earning 2s. 6d. a day; and many journals of influence have discussed the question of such a supposition. It is, however, absolutely untrustworthy; and, with a view to furnishing some definite idea of what the earnings of colliers are, I give the actual figures for three weeks in last July, immediately before the strike, at a large colliery in which I am interested. The number of men who made more than 15s. a day was, in the first week, six; in the second week, seven; and in the third week, two. The number who made upwards of 12s. a day, but less than 15s., was, in the first week, 23; in the second week, 19; and in the third week, 20. The number who made upwards of 9s. a day, but less than 12s., was, in the first week, 50; in the second week, 56; and in the third week, 57. [The writer gives a table showing the earnings per day for each of the three weeks; descending by 6d. per day when below 9s. The miners earning as little as 3s. per day numbered in the first week, seven; in the second week, ten; and in the third week, five.] It will thus be seen that Mr. Woods's statement is a pure flight of imagination. As to what would be the men's earnings if they submitted to the reduction, now fixed at 15 per cent. on the advances, but really amounting to only 10½ per cent. on the gross, it is only necessary to deduct one-tenth from the figures. Thus the man who was making 10s. will make 9s., the man who was receiving 9s. will receive 8s., those who were taking 8s. will take 7s. 3d., he who drew 7s. will draw 6s. 4d., and so on."

The Chairman of the Denaby and Cadeby Main Collieries, near Rotherham, also made the following statement as to the wages of colliers: "As a good deal of misconception appears to prevail with regard to the earnings of colliers, I have caused the wages earned by the men at these collieries in June last (the month immediately preceding the strike) to be abstracted. The results are as follows: For the week ending June 7, the average daily wages were 7s. 5d.; for the week ending June 14, 8s. 2d.; for the week ending June 21, 7s. 5d.; for the week ending June 28, 7s. 2d.—average per day for the four weeks, 7s. 6d. These wages are clear of all deductions, except an infinitesimal sum which the men are liable to pay for tools they may carelessly lose or break—the Company renewing all worn-out ones at their own cost. They are not merely applicable to two or three days in a week, as the men have always been able to work full time—viz., six days per week. For a period of many years the collieries have never been idle a single day, except on holidays or from accidents to machinery. The above being the average wages, they necessarily include the earnings of very indifferent workmen; and, to accentuate this fact, I may mention that the highest wages paid during the period above mentioned amounted to 16s. 6d. per day per man, and the lowest to 3s. 11d. per day per man. The books are open for inspection by any duly authorized chartered accountant employed by the Press for the purpose of proving the accuracy of the above particulars, and any further necessary information will be afforded." This challenge was accepted by the *Sheffield Independent;* and on Saturday Mr. Burbidge, of the firm of Messrs. Knox, Burbidge, and Co., of Sheffield and London, visited the colliery. On the following night he handed in his report. He examined the pay-sheets for four weeks, and found that the net earnings of each collier employed by the Company per shift (a shift representing a day of eight hours), had been: Week ending June 7, 7s. 4·24d.; June 14, 8s. 1·26d.; June 21, 7s. 4·60d.; June 28, 7s. 1·63d. The general average for the month was 7s. 5·97d.

The Secretary of the Coalowners' Federation (Mr. T. Ratcliffe Ellis) last Friday addressed a letter to the Mayor of Sheffield, stating that, as controversy has arisen as to the average amount of wages earned by colliers before the stoppage, the Committee of the Federation invite him to name six chartered accountants of position, one of whom shall be selected by Mr. B. Pickard, M.P., to examine the books of three representative collieries in each district, for the purpose of ascertaining what the earnings of the men really were—the result of the investigation to be published. The Mayor summoned a meeting of Mayors, to be held at Sheffield yesterday, to consider the new development.

Cromer Water Company.—Since 1883, when this Company commenced working, the business has made very fair progress. In that year the revenue amounted to £264; while in the twelve months to March 31 last, it reached £1207. Notwithstanding some exceptional expenditure during the past year, the balance carried to profit and loss account was £629. From this a dividend of 2½ per cent. has lately been declared.

Birkenhead and the Electric Light.—Some months ago the Birkenhead Town Council adopted a resolution in favour of carrying out the provisions of their Electric Lighting Order; and a Sub-Committee was appointed to consider the best means of doing so. They engaged Mr. Shoolbred and Dr. Hopkinson to report on the matter; and these gentlemen have now presented their reports. They state that they consider no great difficulty would be met with in efficiently carrying out the work; but, owing to the straggling character of the district, the cost would be considerable, and this is variously estimated at from £15,000 to £40,000. No decision has yet been come to; but certain members of the Corporation have raised the question as to whether it would not for the present be advisable to let the matter rest, or, on the other hand, permit a private company to undertake the work.

SHEFFIELD UNITED GASLIGHT COMPANY.

Increase in Price.

At a Meeting of the Board of Directors of the Sheffield Gas Company last Friday, it was resolved to immediately increase the price of gas 3d. per 1000 cubic feet. This decision was arrived at after considering a report presented by the General Manager (Mr. Hanbury Thomas), of which the following are the principal portions: "I think the time has now arrived when the effect of the present prolonged coal strike upon the revenue of the Company should be very seriously considered. The stock of coal at the present time is barely sufficient for one fortnight—a dangerously low point for it to be at; and having regard to the fact that the shorter days are now coming on, and the likelihood of fogs causing delay in transit, I must impress upon you the necessity of its being increased without delay. I am aware that this can only be done at a very considerable cost. We have already, during the past three weeks, purchased 10,000 tons of coal at an extra expenditure, over the price we paid last year, of £4795. Should the strike continue, and the Company have to purchase coal from the North for November and December, the increased cost, based on present quotations, would be not less than 10s. per ton, and amount altogether on the 44,931 tons of soft coal—the quantity we used from Oct. 24 to Dec. 31, 1892—to £22,465. To this must be added the amount referred to as having already been expended—viz., £4795—giving a total additional expenditure of £27,260. In the face of this difficulty, it becomes a question whether the Company ought not immediately to raise the price of gas. One penny per 1000 cubic feet on the quantity sold in the year 1892 amounts to £7866; and, after thinking the matter over very seriously, I have reluctantly come to the conclusion that it is my duty to recommend the Board to increase it by 3d. per 1000 cubic feet. I am well aware that this is contrary to the policy the Company has hitherto pursued. Not since 1855 has such a step been taken; but I think that the present circumstances are wholly exceptional. The Company has not earned its full dividend since June, 1890, the revenue having fallen short of the dividend during the last three years by £24,117; and the reserve fund now stands at £11,189 short of its full amount."

BRADFORD CORPORATION GAS, ELECTRICITY, AND WATER ACCOUNTS.

The annual abstract of accounts of the Bradford Corporation for the year ending March 31 last has just been issued by the Borough Accountant (Mr. G. A. Thorpe). The total income in the Gas Department is shown to have been £197,156; and the expenditure, £169,021—giving a gross profit on trading account of £28,135. Against this gross profit sinking fund charges and interest on capital amount to £29,252, resulting in a net loss of £1116. This is the first time—after all expenses (including sinking fund and interest charges) have been met—that the working of the department has resulted in a net loss since the purchase of the undertaking by the Corporation in 1871. In this connection, some interesting information is imparted. The total net profits made by the undertaking since 1871 have been £384,900, £352,500 of which—or an amount equal to no less than three years' income from the borough rate—has been voted in reduction of ratal burdens during the past 22 years. The net loss on the working of the department during the past year is attributable to the decreased income received by the Corporation from the sale of coke and tar. The income from the Electricity Department was £8399; and the expenditure, £3913. This shows a profit on trading account of £4486. Against this is set the sinking fund and interest charges, amounting to £2863, and leaving a net profit of £1623 for the year. Up to the beginning of the past year, the working of the department had resulted in a net loss of £354, which, deducted from the present year's net profit of £1623, leaves an amount of £1269, which may be appropriated as the Council deem advisable. With regard to the Water Department, the total income from water-rents proper was £113,895, and from other sources £8312—a total of £122,207. The expenditure, including interest and sinking fund charges, was £128,168, resulting in a net loss of £5961, which has been met by a reserve fund of £17,700 in hand at the beginning of the year, still leaving about £12,000.

THE HUDDERSFIELD TOWN COUNCIL AND THE LONGWOOD GAS-WORKS.

At the Meeting of the Huddersfield County Council last Wednesday, the General Purposes Committee recommended that the sum of £50,000, subject to the existing mortgage debt of £7200, should be offered to the Longwood Gas Company for their works. The total capital of the Company, it was stated, was £40,420; and the net revenue for the three years ending December last was £5276—giving an average yearly balance of £1758 available for dividend. Alderman Stocks, having moved the adoption of the minutes, Mr. E. Mellor advised that, in view of changes in lighting systems and other circumstances, the Council should hesitate before they spent £50,000 on an old estate. They were at the present time laying out something like £60,000 on their own works, which, he believed, would meet the requirements of the town for many years to come. He moved that the minutes of the Committee should be confirmed, with the exception of the record relating to the purchase of the Longwood works. Mr. J. Lee seconded the amendment. Alderman Taylor said the Longwood people had not asked the Corporation to buy the works; but they desired to be placed on the same terms as the other ratepayers, which it was understood would be the case when they were taken into the borough. If Mr. Mellor resided in Longwood, and paid 5s. per 1000 cubic feet for gas, he would have no objections on this question. Alderman Stocks (the Chairman of the Gas Committee) said they were desirous of keeping faith with the promises made that they would

do justice to Longwood. Commercially, he could assure the Council, this would be a very good speculation. The Corporation works in Leeds Road were undoubtedly capable of supplying Longwood; but the Corporation could not serve that district in face of the statutory powers of the Company, which the Corporation would acquire if they purchased the works. Mr. Hellawell agreed that Longwood should be treated fairly; but, before they committed themselves to this great outlay, they should have the benefit of the facts and figures which Alderman Stocks intimated that he possessed. Alderman Glendinning thought they were bound to offer a reasonable price for the works; and when they had done this, they would have done their duty as far as Longwood was concerned. It was said that the price to be offered was a fair one; but he believed that, when it was made to the Company, they would not take it. Mr. Brearley questioned whether Mr. Mellor knew what he was talking about when he said the works were old. They were comparatively new, and built on modern principles. Mr. Gee protested against the purchase of the works at the price named. He said the statement that the works were modern could not be proved, and would not be accepted by the Chairman of the Gas Committee. Alderman Stocks interjected the remark that they were more modern than those of the Corporation. Alderman Brooke pointed out that the Council were at a disadvantage in not having had a price named by the Company. For eighteen months the Gas Committee had used every available means to ascertain the actual worth of the works, and no good could come of deferring the question. After further discussion, the amendment was declared carried by 28 votes to 23. Subsequently, however, it was agreed to refer the matter back to the Committee for re-consideration.

THE CARDIFF GAS COMPANY AND THE CORPORATION.

From present appearances, it does not seem that the disagreement between the Cardiff Gas Company and the Corporation Lighting Committee with regard to the public lamps is likely to be amicably settled. At a meeting of the last-named body on Tuesday, a letter was read from the Company stating that, in view of the constant complaints received from the Corporation on the subject of repairs, and in view of the fact that the Corporation, although frequently applied to, persistently neglect to afford to the Company that police protection which would be of the greatest possible assistance in keeping the lamps in an efficient condition, the Directors felt they could not saddle the Company with any greater liability than that which was imposed upon them by statute. Consequently they were not prepared for the future to do more than supply the public lamps with gas, in accordance with their statutory liability; and all questions of lighting, extinguishing, repairs, and maintenance would have to be dealt with by the Corporation. It was stated that, in reply to this, the Town Clerk had written to the Company's Solicitors inquiring when they proposed to commence the new arrangement, and what the charge would be in future for the supply of gas to the public lamps, having regard to their restricted obligations. There was very little discussion on the matter. Mr. Jenkins protested against the "manner in which the Company were treating the Corporation;" and the Borough Engineer pointed out that, as the Company had lost money by the public lighting, their action was against their own interests.

Commenting upon the dispute, a South Wales paper says: "The Cardiff Gas Company cannot agree with the Corporation, so the Lighting Committee have received notification that they must light the lamps themselves, and that the Company will do no more than it is absolutely compelled to do—viz., supply the gas for burning. There seems to have been a great deal of letter-writing and portentous formality, and now probably it will be discovered which official on which side has had his feelings ruffled. The private citizen gets on very well with the Company; it is only the organized Municipality which is at loggerheads. Out of the trouble will perhaps re-appear the familiar exhortation, 'Buy up the gas-works.' By all means. The purchase would have been made years ago but for the hopeless blunder of the bargainers on Cardiff's side. These gentlemen wanted to give £506,000 for property worth only £330,000, and with the prospect of immediately-needful outlay on new mains, estimated at £20,000 or more. The Council could not swallow the proposition to give the shareholders a bonus of over 50 per cent. above the market value of their stock, and also face the prospect of new capital expenditure and the competition of electricity and other illuminants. A business-like bargain would have met a better fate."

Kingsbury Water Supply.—A local Government Board inquiry has been held at Kingsbury by Mr. R. Walton, C. E., in connection with the application of the Tamworth Rural Sanitary Authority for permission to borrow £5000 for the purpose of providing a water supply for the inhabitants of Kingsbury. There was a good deal of opposition to the scheme—a canvass having shown a large majority of householders against it; and, moreover, it was urged that the proximity of two collieries might endanger the well. This, however, was controverted by the applicants, who gave evidence showing that there were 750 feet of rock and blue marl between the bottom of the proposed well and the coal measures, and that the collieries were not at present working within 1700 yards of the well.

Inauguration of the Electric Light at Derby.—Last Tuesday week, a portion of Derby was lighted for the first time by electricity from the new works of the Corporation. The ceremony of turning on the current was performed by the Mayor (Mr. W. H. Marsden, J.P.); and the event was celebrated by a banquet at the Royal Hotel, which is one of the establishments supplied with the light. The building of the station has been finished some time; and the machinery and fittings have now nearly all been laid down. The plant includes three 100-horse power compound alternators, three 50-horse power compound alternators, three 30-horse power compound arc lighters, and three 10-horse power exciters, together with an engine to work the condenser. The Engineers for the work were Messrs. Bramwell and Harris; and the plant was provided by Messrs. Siemens Bros.

THE FATALITY AT THE BLACKFRIARS ELECTRIC LIGHT STATION.

At Guy's Hospital, on Monday last week, Mr. A. C. Langham, Deputy-Coroner for Southwark, resumed his inquiry into the circumstances attending the death of Frederick William Ball, who was killed by electricity at the local station of the London Electric Supply Corporation, Blackfriars Road, on the 12th ult. (see *ante*, p. 593). The inquiry, it may be remembered, was adjourned for the attendance of Ernest Meech, another workman, who was seriously injured at the same time, and who has since been an in-patient at St. Thomas's Hospital. Major Cardew represented the Board of Trade; Mr. O. A. Shinner, Government Inspector of Factories, attended from the Home Office; and Mr. Hurd and Mr. Gilbert appeared respectively on behalf of the widow and the Electric Supply Corporation. At the opening of the proceedings, the Coroner announced that he had received a certificate from the doctor at St. Thomas's Hospital to the effect that Meech would not be able to leave his bed for some weeks at least. Further evidence was then given by the Engineer in charge of the station (Mr. J. G. Freeman). He stated that the constant strength of the electricity received into the station was 10,000 volts, which were converted into 2400 volts, and sent into the streets at this pressure. The Coroner inquired if witness could tell them what strength of current would kill a man. Witness said he could not. Personally, he did not think 2000 volts would do it. The strength in the "omnibus" bar was 2400 volts. There was no need for the men to use gloves in the execution of their ordinary work. It would be impossible to protect the bars so that the men could not touch them. Mr. D'Alton, Engineer-in-Chief, in reply to the Coroner, who asked what number of volts would be fatal to a man, said the current to kill a man must go to earth; and it depended upon how the man's connection with the earth was made. He thought 1000 volts had caused death in America. Slate slabs were placed above and below the bars to prevent accidental contact. Major Cardew asked if, assuming that Ball, in pulling Meech away, put one hand on the transformer, this would not have caused him to make a more perfect connection with the earth circuit. Witness replied in the affirmative, and said he thought this was what Ball had done. The Coroner then adjourned the inquiry until Jan. 16, 1894.

LIVERPOOL CORPORATION WATER SUPPLY.

The Past Year's Work.

At the close of the business of the Liverpool Corporation Water Committee last Tuesday, a hearty vote of thanks was passed to the Chairman (Alderman Hughes) for his services during the past municipal year; and, in responding, he briefly reviewed the work of the Committee during that period. He said it was a matter for congratulation to feel that never before had the city and district been so well supplied with water. Owing to the long-continued drought, there had been a great consumption over and above the ordinary supply for sanitary purposes; and it must have greatly conduced to the health of the town that there had been no stint. They had supplied 11 million gallons per week in excess of last year. In addition to this, they had been able to come to the rescue of neighbouring communities who had run short of water; and they had been in the happy position of helping others and at the same time very substantially increasing their own revenue. They had supplied people outside the compulsory area with 266 million gallons, which was something like an increase of 50 per cent. over the preceding twelvemonth. This supply was likely to increase in the future, because they had recently entered into some new agreements; and they had further applications to consider. Turning to the new works, he said they had carried out the South-end main, which was 4½ miles long, and which would afford a systematic supply to that district. Regarding the larger work of the new main from Prescot, which was to give full effect to the Vyrnwy supply, 3½ miles were now laid; but there were still 5 miles in progress. This main would be the crowning work of the Vyrnwy scheme. Then there was the lining of the Llanforda and Cynynion tunnels, which were found to be defective, and which were now being made perfect. Another important matter was the establishment of a telephonic system throughout the whole of the Vyrnwy and Rivington works. They had this year practically completed a system of 120 miles; and it was hardly possible to conceive the important bearing which this would have upon their schemes, because, in addition to giving facilities for sending messages from one place to another, a system of signals would be created by means of which it was hoped that disasters and destruction to property would be prevented. In conclusion, he said, in reference to some complaints as to the colour of the water, that, although the surface water from Vyrnwy was not so clear as the well water, the former was believed to be better as an all-round supply.

THE WATER SUPPLY OF NEWCASTLE.

The Ulleswater Scheme Revived—A Comparison of the Value of the Company's Property Now and in 1874.

The decreasing stock of water in the reservoirs of the Newcastle and Gateshead Water Company has once more brought to the front the Ulleswater scheme, which was propounded by the late Alderman Newall in 1874, in which year the supply of the city was very unsatisfactory. Alderman Cail, who assisted Alderman Newall in his investigations at that time, submitted a long statement on the subject at the meeting of the City Council last Wednesday. He said that Ulleswater was a splendid piece of water, 9 miles long, about a mile broad, and 210 feet deep; and the surface was 476 ft. 6 in. above sea-level. Alderman Newall discovered that it would be possible to supply this water by gravitation to the Tyne Valley, Newcastle, Gateshead, Shields, Tynemouth, and, in fact, to all the Local Boards, towns, and villages from Halthurst to the sea, besides the dense populations as

far as, and including Morpeth. In 1874, the two Aldermen gauged the quantity of water flowing out of the lake through Pooley Bridge, and found that it was 550 million gallons in 24 hours. To take water from this source, they contended that it would not be necessary to raise the surface of the lake by a dam, but merely to take a part of what would be the overflow into an aqueduct; and it would flow to Fenham by gravity, where a service reservoir could be made 360 feet above the sea-level, and 110 ft. 6 in. below the lake. The water could not be used for towns to the south, owing to its being locked in by high mountains. The failures of supply, he said, had been frequent; and the one in 1874 was the climax, when the Water Company were willing to sell their property for a reasonable sum—their capital at the time being £632,000. They required in addition £5 for every £100 share, which made the amount to be paid £663,600 for the whole concern. The matter was taken up by members of the Council, and Alderman Cail's rough estimate, after having gone carefully over the ground, was favourably entertained by some, and violently opposed by others. Meetings were held by the Corporation of Gateshead, who were most enthusiastic to carry out the scheme, and to join Newcastle *pro ratâ*, according to rateable value. The Council of Newcastle and members of the Local Boards of Shields, Tynemouth, &c., were invited to a meeting; and Aldermen Newall and Cail explained the scheme, which was discussed at length, and approved of by the late Mr. T. Hawksley. Rain intervening, the Newcastle Corporation did not accept the terms offered; and the scheme for the time was lost to the proposed Tyne Water Board. The Water Company, instead of going to Ulleswater (which their leading men had so abused), went up the country in a dry zone catching up small streams, and making more reservoirs. Referring again to the question of the purchase of the works, he said that the capital of the Company at the end of 1892 was £1,364,763; and adding (say) £135,237 for work in hand this year, made £1,500,000. The capital in 1874 was £632,000; so that the increase since then had been £868,000. Taking the capital of £1,500,000 at the present market price of £225 per cent., gave £3,825,000; while, in 1874, the offer of the Company was to sell each £100 share for £105, which would have amounted to £663,600—making a difference of £3,161,400 between the present market value and the price offered by the Company in 1874. In concluding his statement, Alderman Cail earnestly asked the Council to consider that they had taken upon themselves the care, prosperity, health, and even life of the people over whom they presided, and to a certain extent of all the other districts in the Tyne Valley who contributed to the prosperity of Newcastle. Having knowledge of all the failures that had taken place during the last 70 years up to the present day, each scheme having failed, and the blame in each case being put on Nature in not discharging more rain, he urged the propriety of having an entire change effected by going to a place where 50 to 200 million gallons of water a day could be procured with certainty and for all time. It was agreed that the statement should be entered upon the record of the proceedings.

Later in the meeting, we regret to say, Alderman Cail was seized with illness, and had to be removed to his residence, where, in the course of the evening, he died, owing to failure of the heart's action.

STOCKTON AND MIDDLESBROUGH WATER BOARD.

The New Works at Hury.

Last Tuesday the Middlesbrough Corporation, together with the Middlesbrough members of the Water Board, proceeded to the valley of the Balder with a view of inspecting the works in progress for the supply by gravitation of pure water from above all sources of pollution to the Teesside towns. The journey originated on a strong complaint by the Sanitary Committee at the extension of the time during which the constituent authorities were being compelled to accept a supply of water taken from the Tees below Barnard Castle; and the object was to show the magnitude of the works in hand, and the remarkable rapidity with which they are nearing completion. On arriving at Hury, refreshments were served in the Board-room; and the Chairman (Alderman Hugh Bell) took the opportunity of describing the works. The whole undertaking has cost up to the present time, including the purchase from the old Water Company, a sum of £1,700,000. The Hury reservoir is now completed; and it has a maximum depth of 100 feet, and a capacity of 900 million gallons. The Blackton reservoir when finished will hold 480 million gallons; and the two together, after supplying to the River Balder 3½ million gallons of compensation water per day, will, in times of exceptional drought, be able to serve the district for 170 days at the rate of 46 million gallons per week. The Board have, however, power to proceed, within the next 18 years, with the construction of the Grassholm reservoir in the adjoining valley, which would then be connected with the valley of the Balder by means of a tunnel. This would hold as much as the two reservoirs now in progress put together; but its construction, which would occupy a period of ten years, will depend upon the development of the district. In his description of the work, Alderman Bell remarked that some surprise had been expressed at the magnitude of the precautions against exceptional floods; but he stated that probably twice in a century there would be a sight which he likened to the rapids of the St. Lawrence below the Niagara Falls, where the water passed down the banks with such velocity that it rose in the centre of the stream above the level of the banks without overflowing. He also explained the various means which had been adopted for keeping the muddy flood water out of the Hury, so that the reservoir might be used for domestic purposes, while the supply in the Balder was devoted to the purpose of compensating the river. After the inspection of the works, the company proceeded to Darlington, where they dined at the North-Eastern Hotel. In acknowledging the toast of "The Health of the Chairman and Members of the Water Board," Alderman Bell, referring to the quality of the present supply, said the water of the River Tees was distinctly improved by the existence of the Hury reservoir and the supply of compensation water. Some time ago a scare was caused by the report of a very eminent member of the Local Government Board; and it was a matter of very great interest to them to consider whether or not that scare was well founded. He would therefore read an extract from the report of the Royal Commission on the London Water Supply, before whom the Tees water was made a subject of discussion. The Chairman of the Commission (Lord Balfour of Burleigh) stated, with regard to the allegation that the outbreak of typhoid on Teesside was due to the pollution of the water supply, that, after hearing the arguments on either side, they refrained from expressing any judgment as to its origin, and adverted to the fact that in time of flood 1000 million gallons of water were passing down the river each hour, so that the suggestion that the outbreak was due to the water supply was a hypothesis so startling that it was fair to demand the most conclusive evidence before accepting it as proven. He thought, therefore, the inhabitants of the valley of the Tees might dispel all fears as to the dangers they ran from any pollution of the water supply as it at present existed. Nevertheless he assured them that the Water Board would leave no stone unturned to secure for them at the earliest possible moment an unlimited supply of pure water.

METROPOLIS WATER SUPPLY.

The Quality of the Water in the Month of September.

The returns furnished to the Registrar-General by the London Water Companies with regard to the water supply of the Metropolis during the past month, show that the average daily supply was 199,725,327 gallons, as compared with 196,716,742 gallons in the corresponding month of 1892. The number of services being 798,253, the rate was 250 gallons to each service. Of the entire bulk of water sent out, 104,052,263 gallons were drawn from the Thames, and 95,673,064 gallons from the Lea and other sources. Reporting upon the quality of the supply, Dr. E. Frankland said: Taking the average amount of organic impurity in a given volume of the Kent Company's water during the nine years ending December, 1876, as unity, the proportional amount contained in an equal volume of water supplied by each of the Metropolitan Water Companies and by the Tottenham Local Board of Health was: Kent, 0·6; Tottenham, 0·9; New River, 1; Grand Junction and East London (deep well), 1·7; Colne Valley, 1·8; East London (river supply), 1·9; Chelsea, West Middlesex, Southwark, and Lambeth, 2. The unfiltered river waters contained the following proportions: New River Cut, 1·9; East London intake, 2·6; and the Thames at Hampton, 3·5. The Thames at Hampton was, on Sept. 25, turbid and yellow in colour. It was, however, both chemically and bacterially, of even better quality than on Aug. 10. Contrasted with the unfiltered water, the supplies of the five Companies drawing from this river showed great chemical, and the following percentage bacterial improvement: Chelsea, 95·25; West Middlesex, 98·1; Southwark, (No. 1 filter) 96·63, (No. 4 filter) 98·79, (gravel water) 94·13; Grand Junction, (Hampton filters) 97·58, (Kew main well) 94·13, (Kew south filter well) 94·47; and Lambeth, 97·75. The water was in every case efficiently filtered; that delivered by the Grand Junction Company was equal, and the remaining waters were nearly equal, to deep-well water in chemical purity. The unfiltered water, taken chiefly from the River Lea by the New River Company, was, on Sept. 26, chemically of exactly the same quality as, but bacterially better than, on Aug. 9. It was turbid and pale yellow in colour, but was efficiently filtered before delivery. It was improved chemically nearly 50 per cent., and bacterially 98·48 per cent.; and, as supplied to consumers, it was fully equal to deep-well water in chemical purity. The raw river water taken from the Lea at Angel Road by the East London Company was chemically of almost the same quality as, but bacterially of much better quality than, on Aug. 9. It was sufficiently filtered before delivery, and was chemically considerably improved. By storeage alone, this Company reduced the number of microbes to the extent of 75 per cent.; and, after filtration, the final reduction amounted to 99·21 per cent. by comparison with the raw river water. The deep-well water of the Kent, Colne Valley, and East London Companies, and of the Tottenham Local Board of Health were of excellent quality for dietetic purposes. All these waters were clear and bright without filtration, except the Tottenham, which was very slightly turbid. The Colne Valley Company's water was softened before delivery; and thus rendered suitable for washing. Seen through a stratum 2 feet deep, the Kent, Colne Valley, and East London (deep-well) waters were clear and colourless; the Tottenham, colourless and very slightly turbid; the New River, clear and nearly colourless; and the remaining waters, clear and very pale yellow. The bacterioscopic examination of the raw river waters, and of those supplied by the various Companies, collected on the 25th, 26th, and 27th of September, gave the results contained in the following table:—

Description.	No. of Microbes per Cubic Centimetre.	Temperature in Deg. C.
Raw River Waters.		
Thames at Hampton	1158	13·8
New River Cut	1053	11·3
Lea at Angel Road	3658	12·0
„ after storeage	921	13·0
River Supplies.		
Chelsea	55	14·0
West Middlesex	22	13·3
Southwark, No. 1 filter	39	12·0
„ No. 4 filter	14	12·0
„ gravel water	68	15·4
Gd. Junction, Hampton, Local Supply	28	13·0
„ „ Kew filter well	68	13·3
„ „ „ south filter well	64	13·2
Lambeth	26	13·3
New River main well	16	12·6
East London, No. 1 Essex well	29	13·6
Deep Well.		
Kent	9	11·5

In the course of their report for the past month to the Official Water Examiner (General A. de Courcy Scott, R.A.), Messrs. Crookes and Odling say: "Of the 182 samples of water examined, three were recorded as "clear but dull;" the remainder being clear, bright, and

well filtered. The meteorological conditions during the month of September have been of an entirely abnormal character. An excess of bright sunshine and high temperature have stimulated the fluviatile vegetation on which the purity of running streams in great measure depends, and have promoted the oxidation of the traces of organic matter always present in river and lake water. The rainfall, as registered at Oxford, has been remarkably small. The mean rainfall of September, from an average of 25 years, is 2·66 inches; whereas the actual rainfall has only been 0·57 inch—showing a deficiency in the month of over 2 inches, and of no less than 3·64 inches for the four months June to September. This deficiency of rain has tended to increase the organic purity of the river, as little or no peaty colouring matter has been washed into it from the collecting area. How little impurity has been present will be seen from the following table, in which a comparison is shown between the average composition of the five Thames-derived waters for last month with that of the same waters in September, 1892, on which occasion we spoke of the composition and purity of the waters as being "entirely satisfactory."

	Common Salt per Gallon.	Nitric Acid per Gallon.	Oxygen required per Gall.	Organic Carbon per Gall.	Colour. Brown. Blue.
Sept. 1892	2·195	0·947	0·643	0·083	15·1 : 20
„ 1893	2·163	0·570	0·026	0·057	12·2 : 20

All the figures are means.

It is not probable that so exceptional a state of things will last much longer; and, as cold, wet weather comes on, a slight increase of vegetable organic matter and peaty colouring matter may be expected.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The experience of the Glasgow Corporation in the working of their electric lighting undertaking furnishes a lesson to other Corporations, which has not been pointed out by the electricians in charge of the installation. As originally designed, the station which the Corporation erected in Waterloo Street was intended to supply 22,000 8-candle incandescent lamps. It is now stated that the number of customers for private lighting (which was 60 when the installation was opened, less than a year ago) has now risen to 268; that the station is working up to its full capacity; and that no more applications for private lighting will be entertained in the meantime. It is therefore proposed to enlarge the capacity of the station to 40,000 lamps. This is all very good; but when it is stated that the station has reached the limit of its load, in the furnishing of a supply equal to 13,000 candles, does it not look as if a mistake was made in the estimate when the station was designed? The installation has cost, stated in round numbers, £100,000; and if it is only able to supply little more than half of the expected output, the estimates upon which the price of current was arranged must have been far out. Other Corporations who are going in for electric lighting had better take note.

The Cleaning and Lighting Committee of the Edinburgh Town Council have resolved to recommend to the Council to light between six and seven miles of the leading thoroughfares by electric arc lights. The recommendation was hurriedly arrived at, because the Board of Trade required information as to how much street lighting was intended to be used, before they sanctioned the borrowing of money. I have been calculating how the cost works out; and probably such of the citizens as may see these "Notes" will be astonished at the result. Taking six miles as the distance, and placing the lamps 90 yards apart, which is not extravagant lighting, about 120 lamps would be required, which, at £20 per lamp, would make a total charge of £2400 a year, irrespective of cleaning and maintenance. On the other hand, with gas-lamps 30 yards apart, which is the average distance in Edinburgh, about 352 lamps will be employed. Each lamp in Edinburgh costs 11s. 9½d. a year for gas, which comes to £206 7s. 1d.; and if seven men were employed to light and extinguish those lamps, and each man had a wage of 22s. a week, the yearly cost for labour would be £400 8s. The total cost of lighting the same thoroughfares with gas, irrespective of maintenance, but inclusive of cleaning, would therefore be £606 15s. 1d. Apart from what the citizens may think of the bill they will have to pay, these figures are interesting as showing how little the Gas Commission will be affected by the change. Probably, as the thoroughfares to be lighted include the leading points, where larger lamps than the ordinary are used, the gas charge will be higher than the average for the whole city; but though it should be put at £300, it is at once seen how little gas revenue would be taken away. It has also to be borne in mind that the profits of the Gas Commission would not be affected, because the Commissioners supply the gas consumed in the public lamps as nearly as possible at net cost price.

The Corporation of Greenock are about to promote a Bill in Parliament, which is intended to give considerable benefits to the citizens. It is proposed to extend the time for repayment of the debt upon the gas undertaking from about 15 to 30 years, by which means an immediate benefit of £500 a year will accrue, increasing by about £120 a year until the whole is paid off. In connection with the Water Trust funds, the benefit will be still greater; the reduction of yearly payment being from £6750 to £2150—an annual saving of £4600. The benefit of thus postponing repayments in connection with both Trusts will be over £5000 a year. This should lighten taxation, and do away with the necessity for appropriating the profits upon the gas undertaking for town purposes.

At the monthly meeting of the Forfar Gas Corporation on Monday night, there were submitted replies from a number of Gas Managers to queries regarding the proposal of the Corporation to erect a new gasholder, and to effect other changes at the gas-works. It was proposed to send these replies to a Committee for a report upon them; but after discussion, they seemed to be pretty much set aside, and the Corporation resolved to call in Mr. T. Douglas Hall, Gas Manager at Montrose, to advise them in the matter.

The Musselburgh Gas Company have been working their new oil-gas plant for about a month; and Mr. W. Thomson, the Manager of the works, expresses entire satisfaction with the results he is getting. Adding one-seventh of oil gas raises the illuminating power of the gas supplied to the town by 5 candles; the quality of the gas sent out being 28 candles. The plant is on the Peebles process. Two retorts are used, which are heated, as in Galashiels, by the same furnace as the coal retorts.

This week the Corporation of Hamilton resolved to apply to the Board of Trade for a Provisional Order, empowering them to supply electric lighting. The resolution was, as in many other instances, by no means a spontaneous one, but was adopted in order to protect the interests of the inhabitants, under the compulsion of an application for an Order, which has been lodged by the Caledonian Electric Supply Company.

Lord Kyllachy was to have heard evidence in the Court of Session on Wednesday in an action relating to gas coal contracts; but the parties effected an extra-judicial settlement. The pursuers, Messrs. Lee and Hart, coal merchants, of St. Vincent Place, Glasgow, sued Messrs. Robert M'Allister and Sons, coalmasters, of Drumbowie, Airdrie, for £208 13s. 3d., as loss and damage sustained by breach of contract. In April and May, 1891, contracts were entered into for the sale by defenders to pursuers of 2000 tons of well-screened Drumbowie cannel, to be delivered during the twelve months following; and in April, 1892, a further contract for 1000 tons was entered into. The price in all the contracts was 12s. per ton, put into trucks at the colliery. The pursuers re-sold the coal to a number of gas companies; and from time to time sent orders to the defenders to forward certain quantities to those companies. The complaint was made that the defenders failed to deliver 1578 out of the 3000 tons; and that coal was habitually sent which was in such a dirty, objectionable, and unmerchantable condition that many of the pursuers' customers repudiated their contracts. The defence was that it was the pursuers who committed the breach of contract, by not taking delivery of coal which was trucked and ready to send out; and, in explanation, it was stated that, after the contracts were entered into, cannel fell in price, and the pursuers purchased coal from other coalmasters at lower rates. Allegations were also made that pursuers failed to send orders at reasonable intervals, and to pay month by month for the coal delivered; and further that the miners were out on strike, which prevented delivery. They reserved their right of action against the pursuers for their breach of contract. The action was settled on the footing of defenders paying £30 to the pursuers, and giving up their counter-claim; and neither party got expenses.

It is reported that Mr. J. Hill, of 34, St. Enoch Square, Glasgow, has, after eleven years' study of the subject of smoke prevention, patented an appliance which is said to accomplish the purpose in a cheap, simple, and effective manner. The invention consists in the placing of a regenerating furnace at the extreme end of the fire bridge. It is in use in both Glasgow and Dumbarton; and it is said to be working satisfactorily.

With reference to the statement in last week's "Notes," that the working of the Gas Department of the Dumbarton Corporation in the past financial year resulted in a deficit of 3d., Mr. J. M'Gilchrist, the Engineer and Manager, writes that this is an error, and that there was, on the contrary, a "handsome surplus." He adds that "last year's accounts show a total loss, in arrears and bad debts, of 3d."—ED. J.G.L.

The Halifax Corporation and Local and Outside Contractors.—At the meeting of the Halifax Town Council last Thursday, the minutes submitted by the Gas Committee contained a resolution accepting the tenders of the Farnley Iron Company, of Leeds, and Messrs. W. Ingham and Sons, of Wortley, for the supply of retorts. This provoked a good deal of discussion—several members urging that the supply of the retorts ought, "on grounds of public policy," to be given to local makers, seeing the difficulty they had in finding work for the unemployed. It was also pointed out that, in previous years, the retorts were furnished by local firms; and they had answered satisfactorily. On behalf of the Gas Committee, it was stated that the same quality of retorts could not be obtained in Halifax as elsewhere. An amendment referring the minute back to the Committee was carried by 23 votes to 17.

The Public Lighting Dispute at Winchcombe.—At the Winchcombe County Court last Wednesday, before his Honour Judge Ellicott, a judgment summons taken out against Mr. G. Troughton, one of the Lighting Inspectors, was heard. At the August Court, as reported in the JOURNAL at the time (see *ante*, p. 419), the Winchcombe Gas Company sued the Inspectors for £49 1s. 3d., of which £38 18s. 1d. had been paid into Court. The Company obtained judgment for the full amount claimed, with costs; and it was to recover the balance and the costs that the present summons was issued. Mr. W. S. Smith, for the Inspectors, contended that the Lighting and Watching Act, under which the proceedings were taken, specified that a Lighting Inspector was not personally liable for payment, and that therefore the judgment summons could not stand. His Honour admitted that the Act, though providing for an Inspector suing and being sued, made it abundantly clear that, if an action went against one, no judgment summons could be preferred against him. On this point of law the present summons could not be maintained. Mr. A. H. Smith, for the Company, said that the effect of his Honour's ruling was that, though judgment was obtained against the defendant, it could not be enforced. He asked leave to appeal against such a decision; and this was granted. We learn from a local correspondent that for the past month the lamps of the town have been lighted with oil; and the general opinion is that the light is most miserable. But it is anticipated that, when bad weather comes on, it will be worse still. The Inspectors say they are lighting with the same kind of lamps, oil, &c., that are used at Winchester. "Whatever the light may be at Winchester," says our correspondent, "it is certainly bad at Winchcombe." There appears to be some personal feeling underlying this dispute; and the public suffer in consequence.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Oct.* 21.

Sulphate of Ammonia.—Some difficulty is experienced in arriving at a conclusion about the true state of the market. The business reported by the dealers is on a constantly declining scale; while it is evidently difficult to buy from the makers at the figures given. Makers seem, in point of fact, to have little to sell. The demand is better; but the bulk of the inquiries is still from the dealers, in execution of old orders. Consumers continue to be under the impression of seeing ultimately reduced values, and buy very sparingly. There is some speculative forward business; but makers do not appear to be anxious sellers. Prices may be taken at anything between £12 10s. and £13.

LONDON, *Oct.* 21.

Tar Products.—The great coal strike has to a large extent interfered with the usual production of tar. There is less coming forward from the gas-works than has been known for years, at this time of the year. This circumstance, together with its application for fuel purposes, the unusual activity of the fuel-works requiring more pitch and the utilization of creosote and common oils for fuel purposes by distillers and others, has had the effect of distinctly strengthening this market; most products being quotable at higher prices. The position is quite abnormal; and there is no doubt it will recede to old values, when the strike ceases. Business is reported at the following prices: Tar, 16s. to 17s. Pitch, 26s. to 27s. Benzol, 50's, 1s. 7d.; 90's, 1s. 6d. Creosote, 2¼d. Creosote salts, 30s. Solvent naphtha, 1s. 3d. Toluol, 1s. 8d. Crude benzol naphtha, 30 per cent., 8d. Carbolic acid, 60's, 1s. 4½d.; crystals, 5¾d. Cresol, 1s. 2d. Anthracene, 30 per cent., "A" 1s. 2d.; "B," 10d.

Sulphate of Ammonia.—There is a surprising inactivity in this market; and there are practically no buyers at the moment. Fortunately stocks are extremely low; many makers are well sold; and it is hoped that the combined effort to reduce the value will fail. Quotations are nominal; but they range from £12 5s. to £12 15s., less 3½ per cent.; while gas liquor is offered at 7s. to 8s.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—The uncertainty which prevailed during last week as to how matters may go on with regard to the continued stoppage of the collieries—whether there might not be considerable defections from the Coalowners' Federation, which would hasten the end of the dispute, or whether the Manchester meeting of the Federated Coalowners might not put forward some proposals which would lead to an amicable agreement between both sides—had the effect of materially unsettling the market. Coupled with this, there were larger supplies coming in from outside districts than had been the case for some time past; and as a good deal of this coal had been bought on speculation by merchants and dealers, some of it was being pushed for sale on the market at considerably under the prices that have recently been ruling. The determined attitude which is still taken by the Federated Coalowners with regard to the reduction in wages has again tended to harden up the market, to the extent that it has, at any rate, checked any tendency to ease down in prices. There is, however, very generally a disinclination to enter into much more than hand-to-mouth transactions at present rates; and a Gas Company in this district have been actually re-selling some of the supplies which had been bought in from Scotland, which have since been readily disposed of for house-fire purposes. The prices may be said to be generally pretty firm at about 18s. to 20s. for engine fuel; 22s. to 24s. for steam coal; with round coals ranging, according to quality, from 23s. and 24s. up to 27s. 6d. and 28s. 6d., delivered at stations or wharves in the district. Odd lots of coal from some of the local collieries that have got back to work have occasionally come upon the market; but for these very high prices are quoted—18s. per ton being asked for very inferior descriptions of slack delivered at stations in Manchester.

Northern Coal Trade.—The coal trade of the North is still benefiting from the effects of the strike in the Midlands; and large quantities of coals continue to be sent from this district into Yorkshire and Lancashire. Indeed, in the last few days there has been increased activity, because it is not believed that the end of the strike in Yorkshire is so near as had been a week or so ago expected. Best Northumbrian steam coals are rather higher than they were—about 14s. 6d. per ton having been paid; whilst the more general quotation is 14s. per ton f.o.b. Second-class steam coals are from 13. to 13. 6d. per ton cheaper. Small steam coals are steady at 5s. 6d. to 6s. per ton; and the inquiry at these rates is brisk. For gas coal there is now an increased demand; but locally it is not up to the recent average for this period of the year. Sales have been made of odd lots at from 9s. 6d. to 10s. 6d. per ton f.o.b.; but coals that have been contracted for use up the great bulk of the production, and for these the average prices will not be much above 6s. per ton. The opening of a new shipping place on the Tyne will do something to increase the facilities for sending away this class of coal, as the new line will tap some of the great gas coal collieries. There is very little alteration in the price for manufacturing coal; but it is steady, and large quantities are being sent to the south of this district. Coke is quiet. Local demands are steady, but shipments are rather limited; and there has been very little addition to the demand for Durham coke from the Midlands. Prices for export vary from 15s. 6d. to 16s. The period for the last shipments of fuel to some of the Baltic ports for this season is now at hand; and this is giving an additional stimulus to the coal trade of the North, at the time when the intensity of the demand is lessened from the Midlands.

Scotch Coal Trade.—Great activity still characterizes the coal trade in Scotland; the demand for supplies to be sent to England being very large. Prices are difficult to quote; everyone working for his own hand. They may, however, be stated approximately at: Main, 10s.; ell, 10s. 3d. to 10s. 9d.; splint, 10s. 6d.; and steam, 11s. per ton, f.o.b. Glasgow. In the West and in Fifeshire, the men are working very steadily. In the Lothians, they are dissatisfied with the award in the arbitration; and, upon the ground that prices have risen since the date taken into account in the arbitration, they have asked an advance of wages to place them on a level with other districts. In support of this demand, they are threatening to work only four days, to restrict the coalmasters' profits from the high prices. The shipments were again very large, but not quite so considerable as last week. The total was 236,237 tons—a decrease of 1848 tons, but an increase, as compared with the corresponding week of last year, of 73,463 tons. For the year to date, the total shipments have been 5,965,980 tons—a decrease, compared with the same period of last year, of 51,100 tons.

Georgetown (British Guiana) Gas Company, Limited.—In the report of the Directors of this Company for the half year ended June 30 last, it is stated that the profit amounted to £1085. This, added to the balance brought forward, after paying interest on the debenture bonds, leaves an available balance of £1426, out of which a dividend is recommended at the rate of 8 per cent. per annum on the preference share capital, and at the rate of 6 per cent. on the ordinary share capital, both less income-tax (except upon those dividends payable to local shareholders).

New Gas and Sewerage Works at Workington.—Last Wednesday, Major-General Phipps Carey held an inquiry at Workington, on behalf of the Local Government Board, respecting an application by the Town Council for a loan of £9000—£7000 of which is required to complete the sewerage works, and £2000 for the extension of the gas-works. With regard to the latter sum, the Gas Manager (Mr. J. Johnstone) stated that it was needed for cranes and a new purifying-house. As to the position of the undertaking, he said the quantity of gas manufactured last year was 54 million cubic feet. Their private customers consumed 44 million cubic feet; and the public lamps nearly 6 millions. The amount of coal carbonized was 6397 tons. Last year the net profit was £1268, with a charge of 2s. 6d. per 1000 cubic feet—the lowest price of any town in the county, except Carlisle. Particulars were also given respecting the sewerage works.

Ceara Gas Company, Limited.—The accounts of this Company for the year ending June 30 last have been issued to the shareholders. They show that there has been a very satisfactory increase of receipts; and but for the enormous item of exchange, the balance of profit would have been the largest in the history of the Company. As it is, the net result is good; there being a profit of £4128, which, added to £788 brought forward, gives a total of £4917. Deducting the interim dividend paid in April (£1709), there remains £3208 available for division. The Directors recommend the addition of £500 to the reserve fund (making £5000 at the credit of that account), and the payment of a dividend for the six months at the rate of 10 per cent. per annum upon both preference and ordinary shares (the dividend on the latter free of income-tax), together £2681, and making with the interim dividend 10 per cent. and 9 per cent. respectively for the year. The balance carried forward will be £526. The second preference capital of £10,000 authorized by the shareholders in October last has been allotted to the extent of £9420, upon which £5 per share (£4710) has been paid.

Colonial Gas Association, Limited.—With the view of extending the sphere of the business of the undertaking, the title of the Australasian Gas Association has been changed to the above, with the approval of the Board of Trade. The annual meeting of the shareholders will be held to-morrow; and the Directors will present accounts which show a profit on the working of £4076, including the dividend on the shares held by the Association in the Charters Towers Gas Company, which, after having applied a considerable portion of their profits to the extension of works, have resumed the payment of dividends. In March last, the Directors declared an interim dividend at the rate of 5 per cent. per annum; and, after providing for interest on loans, &c., there remains a balance, including the amount brought forward, of £1623. They now recommend a dividend upon the amount paid up per share for the second half of the year at the rate of 4 per cent. per annum, free of income-tax, making 4¾ per cent. for the year, which will absorb £1355. The very severe depression in all industrial enterprise in Australia has, the Directors remark, induced great economy in gas consumption; but, with returning prosperity, of which there are signs, there is little doubt the Association will recover the diminution. In October of last year, the Association acquired the Albany (West Australia) and Mount Gambier (South Australia) Gas-Works; and the results of the working at these towns are satisfactory.

Fatality to a Gas-Fitter.—Mr. J. Troutbeck, the Coroner for Westminster, held an inquiry at the Board-room, Ebury Bridge, Pimlico, last Friday, as to the death of Thomas Metcalfe, aged 30 years, a gas-fitter, late of 48, Morton Street, Pimlico. The evidence showed that the deceased was working on the previous Monday in Clarges Street, Westminster, with some other men in the employ of The Gaslight and Coke Company, laying and renovating the service-pipes. The deceased went down the area of No. 24, Clarges Street, to connect the pipes again to the meter, and was shortly afterwards found lying on the ground in an insensible condition. Mary Cox, a domestic servant at the house, stated that at four p.m. she saw the deceased on the area steps. A few minutes afterwards she heard him apparently snoring; and on going out she heard him fall. There was a strong smell of gas at the time, and there had been the whole of the day. Sarah Pauline, the occupier of the house, confirmed the statement as to the smell of gas. Frederick Hood, one of the Company's Inspectors, stated that while the repairs were taking place the gas in that portion of the main in Clarges Street was turned off. The old pipes, however, would give off a strong odour of gas. Mr. A. Evans, House Surgeon at St. George's Hospital, said the deceased was admitted at half-past four on Monday. He was then bleeding from both ears, and had an extensive fracture at the base of the skull. Death took place the following morning. He might have been overpowered by the gas. There was no evidence of a fit. The jury returned a verdict of "Accidental death."

Improvements in the Water-Supply System at Heywood.—The Heywood Corporation Water Committee are about to lay new mains to improve their distribution system, at an estimated cost of £6000.

Electric Lighting for Yeadon.—The Yeadon Local Board last Wednesday instructed their Clerk to make application to the Local Government Board for a Provisional Order giving them power to light the township by electricity, and to ask for sanction to the borrowing of £7000 for the purpose.

The Bacup Corporation and the Rossendale Water-Works.—At the meeting of the Bacup Town Council last Wednesday, it was resolved to acquire, subject to approval by the owners and ratepayers, the undertaking of the Rossendale Water-Works Company. The terms are to be the payment by the Corporation of interest on the paid-up share capital of £26,794, after the rate of 5 per cent. per annum, in perpetuity to the shareholders of the Company.

A New Water Pumping-Station for St. Helens.—The Water Committee of the St. Helens Corporation have come to the conclusion that it is desirable to erect a new pumping-station at Melling, lay a pipe-line therefrom, and duplicate the present pipe-line from Kirkley. In reply to an inquiry from the Town Clerk, the Local Government Board state that they are of opinion that there is no reason why the necessary powers for carrying out this work should not be obtained by Provisional Order; and it has been resolved to take this course.

Sulphate Plant at the Coatbridge Gas-Works.—Messrs. R. and J. Dempster, of Manchester, have just completed a new continuous sulphate of ammonia plant at the works of the Coatbridge Gas Company. The Directors and a few friends interested in the manufacture of sulphate met at the works a few days ago, and inspected the plant in operation. The Manager (Mr. T. Wilson) reported the results to be most satisfactory, and the production of sulphate to be 32 lbs. per ton of coal carbonized. The Directors were highly pleased with the plant.

The Gas and Water Works Purchase Question at Accrington.—A meeting of the ratepayers of Rishton was held last Wednesday, for the purpose of considering a proposition for the purchase of the undertaking of the Accrington Gas and Water Company. The resolution proposed that the Rishton Local Board should, jointly with the Corporation of Accrington and the Local Boards of Church, Clayton-le-Moors, and Great Harwood, promote a Bill in the next session of Parliament for the transfer of the undertaking; and it was carried.

Sales of Shares.—On the 12th inst., stock to the nominal value of £1500 in the *Maidstone Gas Company* (issued under the 1880 Act) was sold by auction, and realized an average of £210 8s. 4d. per cent., or a total of £3156 5s. On the same occasion, £400 of consolidated stock, the dividend on which for the year ending June 30 last was 10¾ per cent., realized £840.——Last Tuesday, Messrs. Bray sold at Hastings four £20 shares in the *Hastings and St. Leonard's Gas Company* at £40 5s. each.——On Friday, 80 £10 shares (£9 paid) in the *Pickering Gas and Water Company*, the dividend on which for several years has been at the rate of 5 per cent., were sold at from £10 10s. to £10 12s.

The Dispute between the Odessa Water Company and the Municipality.—The Directors of the Odessa Water Company have issued a circular to the shareholders, stating that the lawsuits regarding the claim of the Company to be paid for water supplied to the Imperial troops, amounting to £11,209, and the claim of the Municipality for the cumulative fines in respect of cloudy water in the spring of 1881, amounting to 10,500, have been decided by the Senate in favour of the Company. These decisions are final; and the Directors are informed that the troop money will now be paid (although no payment has yet been made), and will not be again questioned. The other fine cases for opalescent water, referred to at the last annual meeting, will not, it is expected, be further prosecuted.

An Electric Lighting Difficulty at Halifax.—The Halifax Electric Light and Power Company have given their customers notice that they will discontinue the supply of electricity after Nov. 18. This decision has been arrived at, owing to the failure of negotiations with regard to the lighting of a portion of the borough, which the Company have carried out during the past three years, and which they offered to continue until the Corporation plant was ready for working, upon the payment of £2000, or, as an alternative, they would accept £4000 for their undertaking. The Company's action will cause a great deal of inconvenience at this season to those tradesmen who, when they adopted the electric light, discarded their gas-fittings; and they have laid their case before the Corporation Electric Lighting Sub-Committee, who have promised to take it into consideration. It will be some time before the Corporation are prepared to supply the light, as negotiations are only now proceeding for the purchase of a site for the works, and up to last Thursday, no reply had been received by the Town Clerk regarding the application of the Corporation for power to borrow £30,000 for carrying out their scheme.

Proceedings in Regard to the New Retort-House at Beckton.—At the Woolwich Police Court, last Friday, The Gaslight and Coke Company were summoned by Mr. Conder, the Woolwich District Surveyor, for erecting a building (a retort-house) at their works at Beckton of greater capacity than 216,000 cubic feet. A second summons charged the Company with neglecting to give notice of putting up the building in question. Mr. Conder said the Company were erecting a retort-house 17 times larger than was allowed by the Building Acts. It had been three years in progress; and no notice was given to him of the intention to build it. For the defence, Mr. G. C. Trewby stated that the house in question was of 4,000,000 feet capacity; and if it were divided it would be impossible for the Company to carry on their works. The gas-works at Birmingham, Leicester, and Newcastle had retort-houses of greater capacity than 216,000 feet. The Company were summoned in a similar case at the Woolwich Police Court in the year 1869; and Mr. Pattison decided that they were exempt from the operation of the Building Acts. The Company were empowered to erect the buildings necessary for the manufacture of gas for the City of London; and the Building Acts could not override the Company's Private Act. Mr. Marsham said he was of opinion that the Company were exempt from the operation of the Building Acts; and he dismissed the summonses without costs.

Bolton Corporation Electric Lighting Scheme.—The Bolton Corporation have received a communication from the Local Government Board, intimating their sanction to the loan of £40,000 in connection with the electricity supply scheme.

The Electric Lighting Scheme for Chester.—Some excitement has been caused at Chester over the proposal of the Corporation Watch Committee that the Hop-pole Paddock should be the site for the new electric lighting station. The recommendation came before the Council at their last meeting, and was very strenuously opposed on account of the site being contiguous to the Cathedral. A memorial was read from the Dean and Chapter, in which it was represented that the station would be a grievous eyesore; that it would be a constant interference with Divine service; and that the walls and the Cathedral would be greatly affected by the works. The Duke of Westminster also telegraphed: "Hear electrics go to Hop-pole Paddock. Hope walls and Cathedral will be spared great degradation that would result." A long discussion took place, in which these arguments were enlarged upon by the opponents, and combated by the supporters of the recommendation, who were armed by a report by Dr. Hopkinson, who was strongly of opinion that the site was the best one for the purpose from an engineering point of view. The Committee's proposition was eventually passed by 18 votes to 10.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 758.)

Issue.	Share	When ex-Dividend.	Dividend on Div. Basis.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk	Yield upon investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	13 Oct.	10½	Alliance & Dublin 10 p. c.	10	16¾–17½*	..	6 0 0
100,000	10	,,	7½	Do. 7 p. c.	10	11½–12½*	..	6 0 0
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	102—104	..	4 16 2
100,000	20	31 May	8	Bahia, Limited	20	10½—11⅛	..	13 18 3
200,000	5	12 May	6¼	Bombay, Limited	5	5⅛—6	..	5 8 4
40,000	5	,,	6½	Do. New	4	3¾—4¼	..	5 13 0
380,000	Stck.	16 Aug.	11⅛	Brentford Consolidated	100	220—225	..	5 2 2
180,000	,,	,,	8½	Do. New	100	165—170	..	5 0 0
220,000	20	15 Sept	11⅛	Brighton & Hove Original	20	41–43	..	5 6 11
888,500	Stck.	31 Aug.	5	Bristol	100	102—105	..	4 15 3
320,000	20	29 Sept.	11⅛	British	20	42–44	..	5 4 7
50,000	10	31 Aug.	11⅛	Bromley, Ordinary 10 p. c.	10	19–20	..	5 15 0
51,510	10	,,	8⅛	Do. 7 p. c.	10	15–16	..	5 6 3
328,750	10	28 July	2	Buenos Ayres (New) Limited	10	5½–6½	..	3 1 6
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	97–100	..	6 0 0
150,000	20	13 July	8	Cagliari, Limited	20	26–28	..	5 14 3
550,000	Stck.	13 Oct.	12½	Commercial, Old Stock	100	245–250*	..	5 0 0
165,000	,,	,,	9½	Do. New do.	100	187–192*	..	4 19 0
160,762	,,	15 June	4½	Do. 4½ p. c. Deb. do.	100	125—130	..	3 9 3
800,000	Stck.	15 June	13	Continental Union, Limited	100	230—235	..	5 10 7
200,000	,,	,,	10	Do. 7 p. c. Pref	100	191—196	..	5 2 0
75,000	Stck.	15 Sept.	10	Crystal Palace District	100	185—190	..	5 5 3
486,090	10	28 July	10	European, Limited	10	21½–22½	..	4 8 11
354,060	10	,,	10	Do. Partly paid	10	15–16	..	4 13 9
5,646,590	Stck.	16 Aug.	12	Gaslight & Coke, A, Ordinary	100	227–231	+1½	5 3 10
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	95–100	..	4 0 0
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	263–268	..	3 14 7
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	120–125	..	4 0 0
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	180–185	+5	4 1 1
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	100	173–178	..	3 18 7
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	262–267	..	3 14 10
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	100	157–162	..	3 14 1
1,061,150	,,	15 June	4	Do. 4 p. c. Deb. Stk.	100	127–130	..	3 1 6
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	132—137	..	3 5 8
908,000	,,	,,	6	Do. 6 p. c. do	100	175–180	..	3 6 8
3,800,000	Stck.	12 May	12	Imperial Continental	100	227–232	–1	5 3 5
75,000	5	15 June	6	Malta & Mediterranean, Ltd.	5	5⅛–5⅜	..	5 4 4
560,000	100	2 Oct.	5	Met. of Melbourne, 5 p. c. Deb.	100	104—106	..	4 14 2
541,920	20	15 June	5	Monte Video, Limited	20	12¼—13⅜	..	7 8 2
150,000	5	31 May	10	Oriental, Limited	5	7⅛–8	..	6 5 0
60,000	5	29 Sept.	7	Ottoman, Limited	5	4–4½	..	7 15 6
166,870	10	—	2	Pará Limited	10	1½–2	..	—
				People's Gas of Chicago—				
420,000	100	2 May	6	1st Mtg. Bds.	100	100—105	..	5 14 3
500,000	100	1 June	6	2nd Do.	100	98–102	..	5 17 8
150,000	10	13 Oct.	5	San Paulo, Limited	10	8½–9⅜*	..	5 5 3
500,000	Stck.	31 Aug.	15½	South Metropolitan, A Stock	100	301–309	..	5 0 4
1,350,000	,,	,,	12	Do. B do.	100	248–253	..	4 14 10
260,000	,,	,,	13	Do. C do.	100	259–264	..	4 18 5
750,000	,,	13 July	5	Do. 5 p. c. Deb. Stk.	100	148–152	..	3 5 9
60,000	Stck.	31 Aug.	11½	Tottenham & Edm'nton, "A"	100	210–215	..	5 7 9
				WATER COMPANIES.				
744,897	Stck.	29 June	10	Chelsea, Ordinary	100	270–275	+2	3 12 9
1,720,252	Stck.	13 Oct.	8	East London, Ordinary	100	215–220*	..	3 12 9
544,440	,,	29 June	4½	Do. 4½ p. c. Deb. Stk.	100	140—143	..	3 2 11
700,000	50	15 June	8½	Grand Junction	50	113—117	..	3 12 8
708,000	Stck.	16 Aug.	11	Kent	100	285—290	..	3 15 10
1,043,800	100	29 June	9½	Lambeth, 10 p. c. max.	100	245—250	+1	3 16 0
406,200	100	,,	7½	Do. 7½ p. c. max.	100	199–204	..	3 13 6
310,000	Stck.	29 Sept.	4	Do. 4 p. c. Deb. Stk.	100	128—131	..	3 1 0
500,000	100	16 Aug.	12½	New River, New Shares	100	335—340	..	3 11 4
1,000,000	Stck.	28 July	4	Do. 4 p. c. Deb. Stk	100	132–135	..	2 19 3
902,300	Stck.	15 June	6	S'thwk & V'xhall, 10 p. c. max.	100	155–160	..	3 15 0
126,500	100	,,	6	Do. D 7½ p. c. do.	100	145–150	..	4 0 0
1,155,066	Stck.	15 June	10	West Middlesex	100	262–267	..	3 14 10
						*Ex Div		

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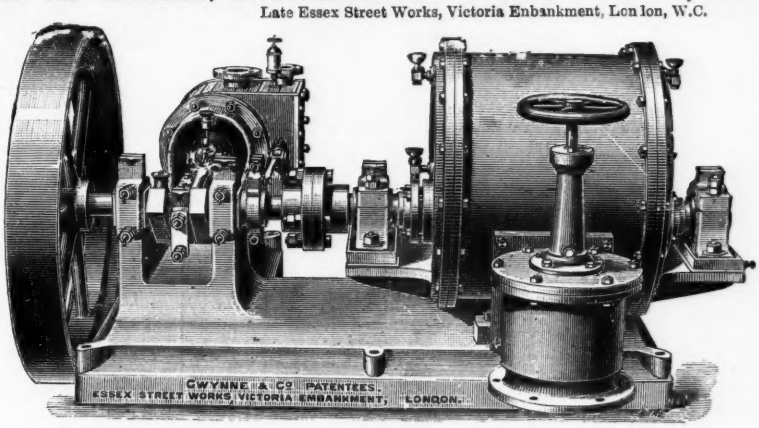

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JAMES LAWRIE & CO. supply Best SCOTCH CANNEL COALS, Best FIRE-CLAY RETORTS, BRICKS, TILES, and LUMPS; BOILER SEATING BLOCKS, FLUE COVERS, and SILICA BRICKS for SPECIAL FURNACE WORK; COKE BARROWS, BOGIES, and SMALL WAGONS.
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W. C. HOLMES & Co., Huddersfield; AND 80, CANNON STREET, LONDON,
Contractors for Gas-Works complete, Makers of Gasholders, Purifiers, Scrubbers, Condensers, Retort Fittings, &c., Improved Valves, Engines, and Exhausters. Also for Collingwood's Regenerative Retort-Settings.
*** See Advertisement p. II., centre of JOURNAL.
Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

J. & J. BRADDOCK, Globe Meter Works, Oldham.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
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INVENTIONS Protected by Letters Patent. TRADE MARKS REGISTERED at home and abroad. Advice on all questions relating to above. Handbook gratis.
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LIQUOR, Tar, and Spent Oxide wanted.
BROTHERTON AND CO., Ammonia and Tar Distillers, BIRMINGHAM, LEEDS, and WAKEFIELD.

WANTED, by a young married Man, a Situation as WORKING MANAGER of Gas-Works. Has held his present management four years (steam engine and exhauster employed).
Apply, by letter, to No. 2290, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by the Advertiser (aged 29, and total abstainer), a Situation on a Gas-Works as ASSISTANT to Engineer or Manager, or Bookkeeper. Six years in present Situation. Speaks Portuguese thoroughly. No objection to go abroad. Will be disengaged by end of January, 1894. Good references.
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WANTED, immediately, for a few weeks, in a Country Gas-Works, a good GAS-FITTER, well up in Service laying and Meter fixing.
Apply, stating wages, to No. 2295, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Gas-Fitter, well up in Stoves, Fires, Regenerator Burners, &c.
Apply, stating experience and wages required, to No. 2294, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

DENBIGH GAS COMPANY.

WANTED, for the above Company's Works, a WORKING MANAGER. Applicants must have a thorough practical knowledge of Gas Making, as well as be fully competent to take charge of the usual Plant connected with such Works, and also of Main and Service laying. Preference will be given to one having knowledge of Fitting. Wages, 30s. per week, with Cottage, Coal, and Gas.
Applications, stating qualifications, with testimonials, to be sent forthwith to the SECRETARY of the Company, DENBIGH.
Oct. 19, 1893.

IRISH BOG ORE OXIDE OF IRON.

GAS PURIFICATION.

BALE & CO., direct Importers from Ireland. Sample and Price on application.
OXIDE PAINT, SULPHURIC ACID, & Chemicals.
190 and 191, NEWGATE STREET, LONDON, E.C.
Telegrams: "BOGORE, LONDON."

OXIDE OF IRON.

FINEST Quality of Natural Bog Ore. Particulars and price, apply to Mr. T. L. ARCHER, 20, Fennel Street, MANCHESTER.

MESSRS. DEBENHAM, TEWSON, FARMER, and BRIDGEWATER'S MONTHLY LIST of Shops, Show-Rooms, Factories, and Waterside Premises, suitable for the Exhibition and Manufacture of Engineering and other Appliances, may be obtained, free of charge, at their Offices, 80, CHEAPSIDE, E.C.

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JOHN NICHOLSON & SONS, Chemical Works, LEEDS, specially produce this ACID from BRIMSTONE, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

SADLER AND CO., LIMITED, MIDDLESBROUGH; ULVERSTON (BARROW); PORTSMOUTH; CARLTON; STOCKTON; 315, St. Vincent Street, GLASGOW; and 85, Water Street, NEW YORK. Tar Distillers, Manufacturers of all TAR PRODUCTS, ALIZARINE and other TAR COLOURS, BICHROMES, OXALIC ACID, ALKALIES, LIQUOR AMMONIA, AMMONIA SULPHATE, &c.
Head Office: MIDDLESBROUGH. Correspondence invited.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors, for the erection of Gas-Works for Towns, Villages Mansions, Manufactories, Collieries, and Isolated Buildings, at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER, LINCOLN."

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FOR SALE—Three 6-feet square PURIFIERS, complete with lifting arrangement, 6-inch Valves, and Connections. Repaced by others of larger capacity.
Apply to F. TURNER, Manager, Gas-Works, CHARD.

THE Madeley Coal and Iron Company, Limited, Madeley, near Newcastle, North Staffordshire, have some GAS COALS to sell. Prompt delivery.
Telegraphic Address: "SETTLE, MADELEY, STAFFS."

SPECIAL BARGAIN.

FOR SALE—A perfectly new 30,000 feet per hour HORIZONTAL DOUBLE PUMP RECIPROCATING EXHAUSTER, with Steam-Engine, with Connections and Valves.
One Second-hand (thoroughly overhauled) VERTICAL PUMP EXHAUSTER, with Steam-Engine (with clean Water and Liquor Pumps attached), to pass 7000 cubic feet of Gas per hour.
The whole of the above plant can be inspected, and full particulars with prices will be sent, on application to No. 2241, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

G. L. LAMBERT, 26, Alberta Terrace, Nottingham. Consultations, Advice, Reports in Various Branches of **Practical** Mechanical Engineering and Machinery. **Specialities** in Water, Sewage, and Gas Plant Making. **Surveyor** of Steam-Ships, Marine Engines, Boilers, and General Machinery. **Detailed Inspection** of Engineering Contracts during Manufacturing and Erection.

TO GAS AND WATER COMPANIES AND MANAGERS.

AN ASSOC.M.INST.C.E. having an extensive experience in GAS and WATER WORKS' DESIGN and ERECTION, now Chief Assistant in a large Gas-Works and Engineer to several small ones, having designed and erected a THREE HUNDRED and a ONE HUNDRED MILLION GAS-WORKS complete, besides several small ones, also ENLARGED many other Works, including NEW LIFTS to EXISTING GASHOLDERS, REGENERATIVE SETTINGS, &c., would be pleased to VISIT WORKS and ADVISE on their EXTENSION or ALTERATION, making SPECIFICATIONS, DRAWINGS, ESTIMATES, and superintend erection if desired.

SPECIALITIES.

Any EXTENSION or ALTERATION to GAS or WATER WORKS. ASSESSMENT of Gas-Works. New HOLDERS, TANKS, ROOFS. PURIFIERS, or FILTER-BEDS. TELESCOPING or adding FRESH LIFTS to EXISTING HOLDERS. REGENERATIVE SETTINGS, for SMALL GAS-WORKS, without Excavations. SAVING 20 PER CENT. in first cost, renewals, and working.

Address "Boz," 9, Gracechurch Street, LONDON, E.C.

FIRE-CLAY GOODS.

THE Directors of the Sheffield United Gaslight Company invite TENDERS for the supply of FIRE-CLAY GOODS (Retorts, Bricks, &c.) required for repairs at their Neepsend and Effingham Street Stations during the next Twelve Months.

Specifications and Forms of Tender may be had on application to the Company's Engineer, Mr. Fletcher W. Stevenson.

The Directors do not bind themselves to accept the lowest or any tender.

Sealed tenders, marked "Tender for Fire-Clay Goods," must be delivered, by post, addressed to the undersigned, not later than Saturday, Nov. 4 next.

HANBURY THOMAS,
General Manager.

Commercial Street, Sheffield,
Oct. 13, 1893.

WALLASEY LOCAL BOARD.

NEW GAS-WORKS.

TO ENGINEERS AND MAKERS OF GAS PLANT.

THE Wallasey Local Board invite TENDERS for the whole or any portion of the under-mentioned WORKS:—

Contract 5—ANNULAR CONDENSERS.
Contract 6—ROTARY EXHAUSTERS and ENGINES.
Contract 7—TOWER SCRUBBERS.
Contract 8—PURIFIERS, FLOORING, &c.
Contract 9—MORTAR MILL and ENGINE.
Contract 10—LOCOMOTIVE TANK ENGINE.

Copies of the Specifications may be obtained on application to the Engineer, Mr. H. Ashton Hill, Assoc.M.Inst.C.E., at the Gas and Water Works, Great Float, near Birkenhead.

A charge of 10s. 6d. will be made for copy of each specification, to be returned on receipt of a *bond-fide* tender.

Sealed tenders, on the form provided for the purpose, addressed to the Chairman of the Gas and Water Committee, and endorsed "Tender for Condensers" (or any other contract, as the case may be), to be delivered at my Office, Church Street, Egremont, Cheshire, not later than Five o'clock p.m., on Monday, Nov. 27.

Each Contractor will be required to enter into a bond with approved sureties, for the due performance of the contract, which contract and bond will be prepared at the expense of the Contractor.

The Board do not bind themselves to accept the lowest or any tender.

By order,
W. DANGER,
Clerk to the Board.

Public Offices, Egremont, Cheshire,
Oct. 13, 1893.

Price 2s. per dozen, or 10s. 6d. per 100, post free.

CONSPIRACY and Protection of Property Act. It is required, under a Penalty of FIVE POUNDS, that a Printed Copy of the 4th Section of this Act shall be posted up at all Gas-Works, in a conspicuous place, where the same may be conveniently read by the persons employed thereat.

Printed copies of this Section, in large type, on broad sheets, may be obtained of WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

*** *The Act extends to Scotland and Ireland.*

ROBERT MARSHALL,
CANNEL COAL MERCHANT,
97, WELLINGTON STREET, GLASGOW.

Prices and Analysis of all the Scotch Cannels on application.

HEBBURN MAIN GAS COALS.

Yield of Gas per ton . . . . . 10,500 cubic feet.
Illuminating Power . . . . . 16·4 candles.
Coke . . . . . 68 per cent.

For prices, f.o.b. Ship or Delivered by Rail, apply to

THE WALLSEND & HEBBURN COAL COMPANY, LTD.,
B Lombard Street,
NEWCASTLE-ON-TYNE.
W. RICHARDSON, Fitter.

Now Ready, Price 15s., Limp Cloth, the Thirteenth Yearly

ANALYSIS OF THE ACCOUNTS OF THE Metropolitan Water Companies,

Chelsea, East London, Grand Junction, Kent, Lambeth, New River, Southwark and Vauxhall, and West Middlesex—showing the Capital, Income, Expenditure, Profits, and Dividends per Million and per Thousand Gallons of Water supplied; the proportion of Expenditure and Profits to gross Income; and the Income, Expenditure, and Profits per House, &c., supplied for the year ended December 31, 1892, or March 31, 1893, together with the quantity of Water supplied, the estimated daily quantity supplied for domestic and other purposes, the quantity supplied per head of population, &c., &c., for the year ended December 31, 1892.

Compiled and arranged by
ALFRED LASS, F.C.A.

LONDON:
WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

Just published, Price 7s. 6d.

THE REGISTRATION OF TRANSFERS Of Transferable Stocks, Shares, and Securities;

With a chapter on the Forged Transfers Acts, and an Appendix of Forms for Directors, Secretaries, Registrars, and Officers of Public Companies and other bodies.

BY GEORGE ENNIS *AND* GEORGE FRANCIS MACDANIEL ENNIS,
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Improved Slide-Valve Anti-Dip.

Is perfectly reliable in action, and requires no attention. Has all the advantages of the Dip and Anti-Dip combined.

Is cheap and easily fixed to any form of main.

Will be found the most efficient appliance of the kind yet introduced.

Further particulars and price from

C. MEIKLEJOHN,
GAS-WORKS, RUGBY.
(Late N. MEIKLEJOHN, Longwood.)

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD
BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.
RAVENSTHORPE, NEAR DEWSBURY.

NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

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NEWBATTLE COLLIERIES,
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THE SILICA FIRE-BRICK COMPANY,
OUGHTIBRIDGE, near SHEFFIELD,
MANUFACTURE
SILICA BLOCKS, BRICKS, AND CEMENT
OF SUPERIOR QUALITY
FOR GAS-FURNACES.

Trade Mark: "SILICA."

These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their
GREATER DURABILITY
Strongly recommended where EXCESSIVE HEATS have to be maintained.

For **FIRE-BRICKS,** the most durable for **GAS-FURNACES,**
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JAMES WHITE & Co., Limited,
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COKE BREAKERS,
PRICES REDUCED.
(THOMAS & SOMERVILLE'S PATENT.)
New Design, with two Cutting Rollers, making less Breeze than their old pattern.

For Exhauster Advertisement, see last week.

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PARK STREET, SOUTHWARK, E.C.,
And at STROUD, GLOUCESTERSHIRE.

LONDONDERRY GAS COALS
FROM THE
MARQUIS OF LONDONDERRY'S COLLIERIES,
COUNTY OF DURHAM.

Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by
Mr. John Pattinson, F.C.S., F.I.S.

FOR PRICES AND PARTICULARS, APPLY TO
S. J. DITCHFIELD,
SEAHAM HARBOUR, COUNTY OF DURHAM.

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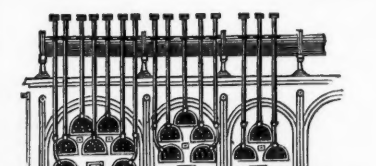

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THOMAS TURTON AND SONS, LIMITED,
SHEAF WORKS, SHEFFIELD,
MANUFACTURERS OF
FILES OF BEST QUALITY
FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.
SCREW STOCKS, TAPS AND DIES,
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HOLMSIDE GAS COALS.

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PRESENT production 4000 tons per working day. Area of coal about 5000 acres, including the largest remaining workable proportion of pure HUTTON SEAM GAS COAL. Analysis of HOLMSIDE GAS COAL *in bulk as shipped* gives 10,500 cubic feet of Gas per ton, of an Illuminating Power of 16½ candles. The Sulphur is about 1 per cent., and the Ash 1¾ per cent. The Coal cokes well, and leaves about 70 per cent. of excellent Coke. To show the progress of HOLMSIDE COALS, it may be mentioned that the quantity carbonized by the London Gas Companies in 1885 was about 200,000 tons; whereas the present consumption of HOLMSIDE COALS in London alone is at the rate of nearly

600,000 Tons per Annum.

Full particulars on application to

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HOLMSIDE AND SOUTH MOOR OFFICES, NEWCASTLE-ON-TYNE.

NIDDRIE CANNEL

A FIRST-CLASS CANNEL COAL,

Yielding a large volume of rich Gas, and fully 60 per cent. of first-class Coke.

FOR ANALYSIS, PRICE, AND ALL OTHER PARTICULARS, APPLY TO

The Niddrie & Benhar Coal Co., Ltd., 15, HANOVER STREET, EDINBURGH.

Telegrams: "BENHAR, Edinburgh."

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

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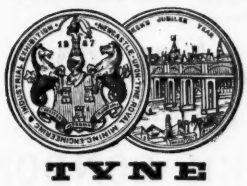

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BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL

Yield of Gas per ton	10,500 cub. f
Illuminating Power	16·3 candles
Coke	70 per cen'.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

For Prices and complete Analysis, apply to

THOS. W. DANCE & SONS,

COAL OWNERS, NEWCASTLE-ON-TYNE;

OR

E. FOSTER & CO.,

21, JOHN STREET, ADELPHI, LONDON, W.C.

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ALFRETON IRON-WORKS, DERBYSHIRE,

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Manufacture and keep in Stock at their Works

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PIPES and CONNECTIONS, 1¼ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas Water, Railway, Telegrapb, Chemical, Colliery, and other Companies.

NOTE. — Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts, and covers, and rendering leakage impossible.

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Pipes, One to Six inch Bore, kept in Stock. Also a very large assortment of all sizes of Bends, T-pieces, and Specials ready for despatch on receipt of Order.

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FOR GAS, WATER, AND STEAM.

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BOLDON GAS COALS.

Worked by THE HARTON COAL CO., LTD.,

Output about 3000 tons per day.

ANALYSIS—

Yield of Gas per ton	10,500	Cubic Feet.
Illuminating Power	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Commercial Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Ipswich Gaslight Company, Devonport Gas Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For prices, &c., apply to the

HARTON COAL COMPANY, LIMITED,

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W. H. PARKINSON, FITTER.

T.B.KITTEL. SHEFFIELD.

CONTRACTS FOR SUPPLIES OF ANY OF THE PRINCIPAL

ENGLISH & SCOTCH CANNELS.

REAL SILKSTONE GAS COAL

ANALYSIS AND PRICES ON APPLICATION.

T.B.KITTEL. SHEFFIELD.

TROTTER, HAINES, & CORBETT,

Brettell's Estate

FIRE-CLAY & BRICK WORKS,

STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.

Proprietors of

BEST GLASSHOUSE POT & CRUCIBLE CLAY.

SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

AUG. KLÖNNE,

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REGENERATIVE FURNACES.

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OXIDE OF IRON.

JAMES HUNTER, LESSEE, MINER, AND SHIPPER OF NATURAL IRISH BOG ORE.

This Estate yields the finest and most uniform quality in Ireland; and the quality is guaranteed

Samples and Prices on application.

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Telegrams: "HUNTER PORT GLASGOW."

Established 1872.

THORNLEY GAS COALS

WORKED BY THE

WEARDALE IRON AND COAL COMPANY, Ld.

OUT OF THEIR

THORNLEY AND WHEATLEY HILL COLLIERIES.

The Analysis made by Messrs. J. and H. T. Pattinson, Public Analysts for Northumberland, gives 10,500 cubic feet of Gas per ton, with an Illuminating Power of 16·3 Candles and 67·3 per cent. of Coke. The following is a Working Analysis made of these Coals by the Tudhoe and Sunderland Bridge Gas Company:—

[COPY.]

TUDHOE AND SUNDERLAND BRIDGE GAS COMPANY.

Tudhoe Gas-Works, Spennymoor, 8th June, 1893.

Messrs. The

WEARDALE IRON & COAL COMPANY, LTD.

GENTLEMEN,

For the last two months we have used your **THORNLEY GAS COAL** exclusively at these gas-works; and I have pleasure in herewith giving you the actual results obtained during the trial.

Yield of Gas per ton: 10,300 cubic feet.

Yield of Coke: 13½ cwt.

Illuminating Power of Gas, average of a series of tests, **17 Sperm Candles.**

The Coke was of excellent quality.

The following is a complete ultimate Analysis of the Coal.

	Per Cent.
Carbon	83·128
Hydrogen	5·116
Oxygen	7·401
Nitrogen	0·585
Sulphur	0·620
Ash	3·130
Water	0·020
	100·000

Analysis of the Coke.

Carbon	93·31
Sulphur	0·61
Ash	5·00
Moisture	1·08
	100·00

I am, Gentlemen,
Yours truly,
A. B. COWAN,
Manager.

For Price, &c., apply to the

WEARDALE IRON & COAL Co., Ld.

QUAYSIDE, NEWCASTLE-ON-TYNE.

Price: Morocco, Gilt, 18s.; Cloth, 15s.; Delivered Free.

THE FIFTH EDITION OF THE

HANDBOOK

FOR

Gas Engineers and Managers,

By THOMAS NEWBIGGING, M.Inst.C.E.

London: WALTER KING, 11, Bolt Court, Fleet St., E.C.

HYDRATED OXIDE OF IRON

FOR GAS PURIFICATION.

Two to three times as rich in Hydrate as Bog Ore.

STRONG ACTION ON SULPHURETTED HYDROGEN.

We have for sale Hydrate of Iron containing 77 per cent. of Ferric Oxide and 17 per cent. of Water. Directions given for mixing for Purifiers.

LESS THAN HALF THE PRICE OF BOG ORE.

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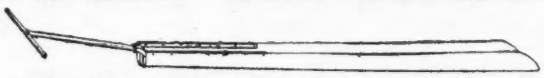
STEEL SCOOPS

FOR

RETORT CHARGING.



Scoops supplied with or without handles, and of any dimensions or shape required.

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HARPER & MOORES,

STOURBRIDGE.

MANUFACTURERS OF

BEST FIRE-BRICKS, GAS-RETORTS,

LUMPS, TILES, AND ALL ARTICLES IN FIRE-CLAY.

Proprietors of Best Glasshouse Pot, Crucible, and other Stourbridge Clays.

MANUFACTURERS OF GLASSHOUSE POTS AND CRUCIBLES OF EVERY KIND.

ESTABLISHED 1836.

THE DEIMEL GAS-LAMP.

Absolutely the Cheapest, Simplest, and most Economical Lamp before the Public.

Suitable for Suspension, or can be fixed to the ordinary Bracket in place of Burner.

Price of **Bracket Lamp, from 13s.**

Price of **Suspension Lamp, from 21s.**

Consumption 6 and 9½ cubic feet respectively.

Proprietors: THE DEIMEL LIGHT COMPANY, LIMITED,

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LIBERAL DISCOUNT TO GAS COMPANIES.

HULETT'S

PREPAYMENT GAS-METER.

"PENNY-IN-THE-SLOT."

IN CAST-IRON CASE,

Of neat design and finish.

D. HULETT & CO., LIMITED,

Dry Meter Makers to H.M. Government, &c.,

55 & 56, HIGH HOLBORN, LONDON.

WILLEY & Co.,

Gas Engineering Works, Commercial Road, Exeter,

MANUFACTURERS OF EVERY DESCRIPTION OF

GAS APPARATUS.

GASHOLDERS, Telescope and Single Lift, any size. Some of the largest in the Kingdom, erected by this Firm, are giving the highest satisfaction.

PLANS and SPECIFICATIONS furnished for **Extensions** and **Enlargement** of existing **Works,** adapting them to the most **Improved** and **Modern Principle** of **Gas Manufacture.**

PURIFIERS, CONDENSERS, WASHERS, ENGINES and EXHAUSTERS, STATION METERS and GOVERNORS, manufactured and erected.

Makers, by permission of that eminent authority **MR. GEORGE LIVESEY,** of his **CELEBRATED PATENT WASHER,** highly approved by all the Engineers of Works where adopted. Largely in demand.

Special reference and attention are invited to our

WET AND DRY METERS,

which have acquired a high reputation for the **excellence** of Materials and Workmanship; their **durability** and **accuracy** of **Register** guaranteed. They are used by several of the **London Gas Companies,** and over **200 Provincial Gas Companies.**

Price Lists, Specifications, and Estimates provided for any work appertaining to Gas Lighting, from the Retort-House to the Drawing-Room.

HEATHCOTE GAS COAL.

RICH IN ILLUMINATING POWER AND YIELD OF GAS.
ABOVE THE AVERAGE IN WEIGHT AND QUALITY OF COKE.
MAINTAINS A HIGH STANDARD IN RESIDUALS.

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MAKERS OF

WORKS LEEDS

THE LARGEST GASHOLDER IN THE WORLD.

CAPACITY 12 MILLION CUBIC FT.

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NO WIRE ROPES OR SPIRAL GUIDES REQUIRED IN THIS SYSTEM.

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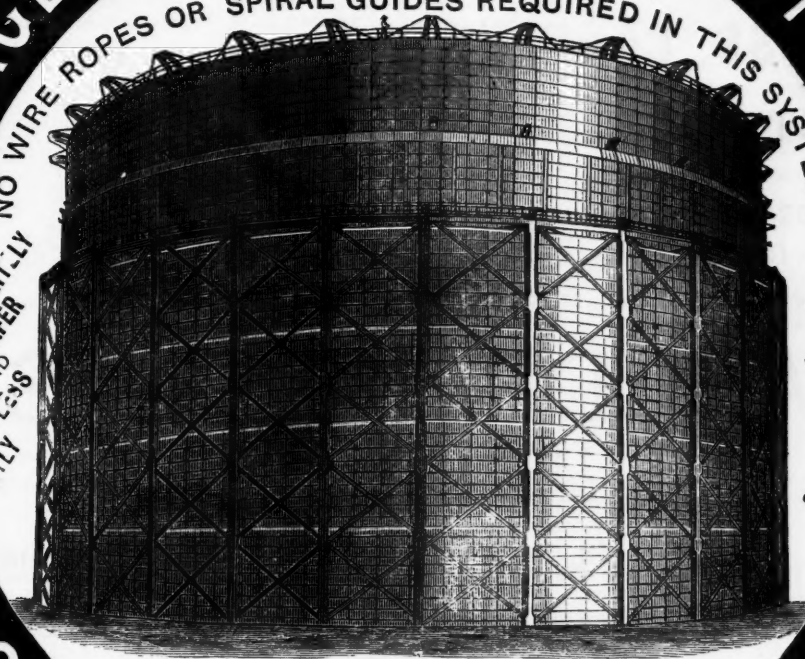

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IT HAS SIX LIFTS 30 FT DEEP EACH AND IS 300 FT DIAR

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A. G. GLASGOW. M.E.,
Late General Inspector,
The United Gas Improvement Company, U.S.A.

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1. Smooth interior, preventing adhesion of Carbon.
2. They can be made in one piece up to 10 feet long.
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MACHINE-MADE GAS-RETORTS.

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Sulphate of Ammonia Apparatus.

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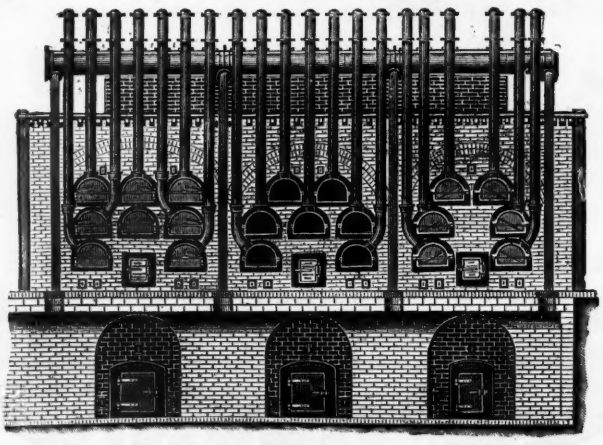

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Makers of every kind of Gas Apparatus and Structural Ironwork.

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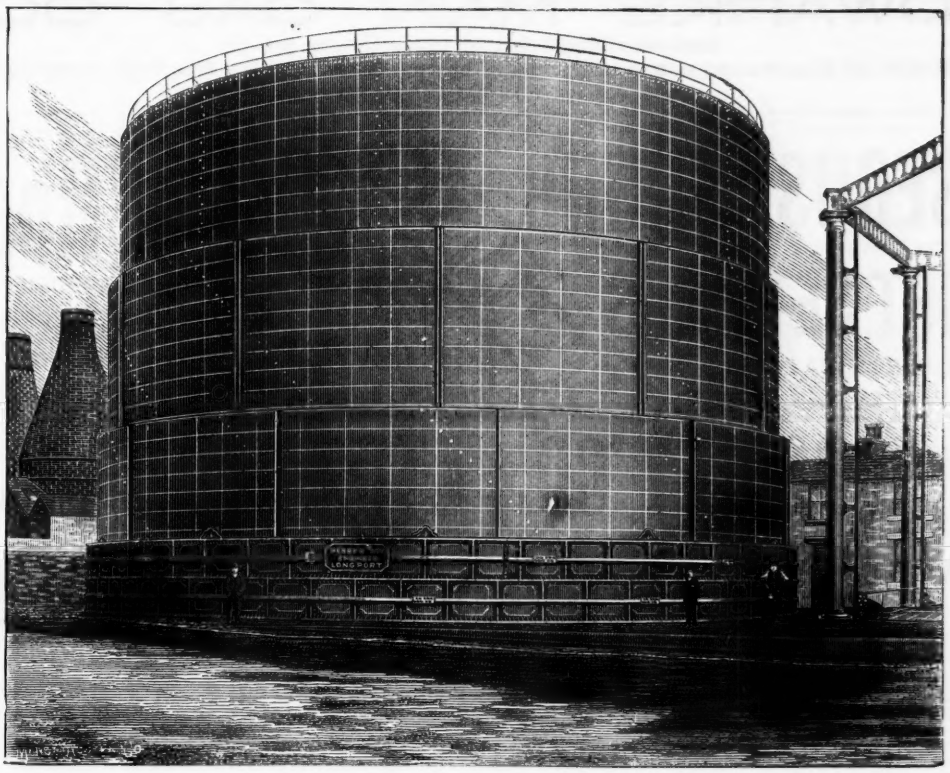

Three-Lift Spiral-Guided Gasholder, working in a Cast-Iron Tank made with planed joints, erected at the Longport Gas-Works of the Burslem Corporation. Bottom Lift, 90 ft. diameter and 20 ft. deep.

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JOHN BROWN & CO., LTD., SHEFFIELD,

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Analysis: 12,600 feet of 19-candle gas per ton.

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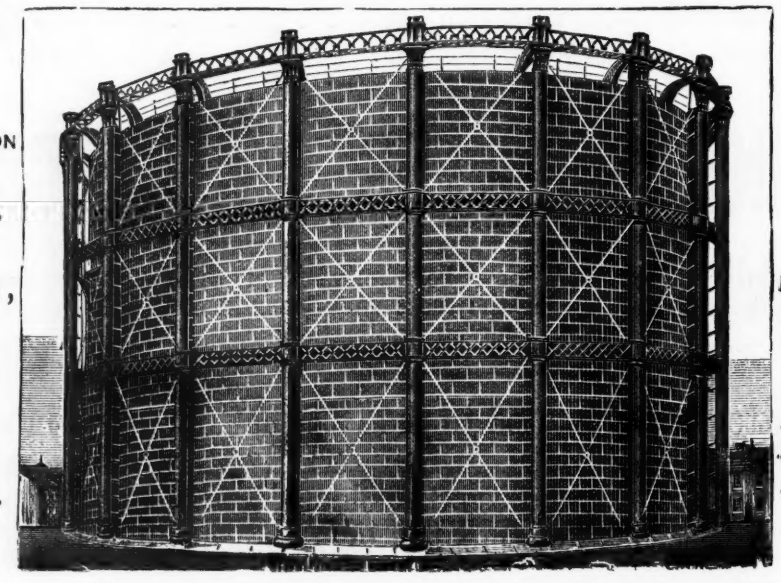

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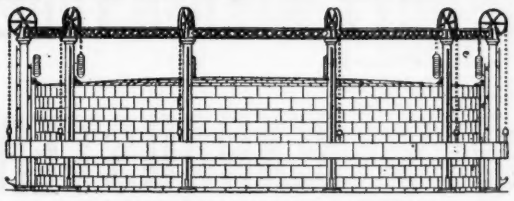

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A 280-CANDLE POWER PLAIN IRON LAMP,

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The force of the Piston Pump with the capacity of the Centrifugal combined.

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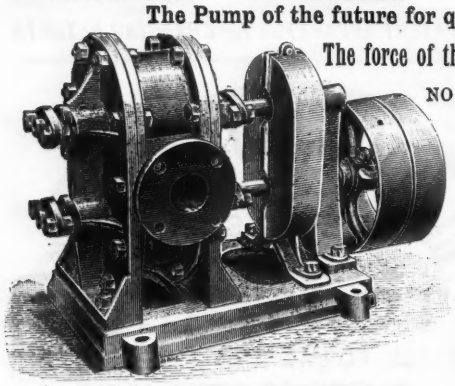

As supplied to the Harrogate Gas-Works for Pumping Gas Liquor.

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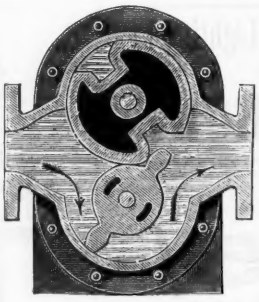

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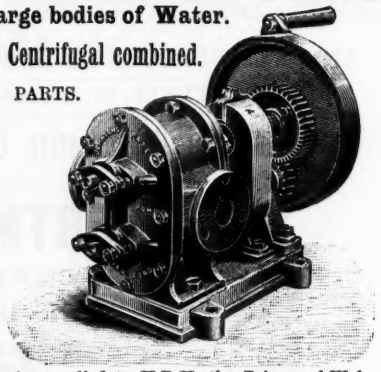

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The most efficient Machine known for extracting Ammonia and other Impurities from Coal Gas is

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The Patent Wooden Balls thoroughly break up the Gas; give an immense amount of freshly-wetted Surface; and do not clog or increase back pressure.

Whilst the Gas is passing through and amongst the Balls, it is continually showered upon by the contents of Buckets.

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London: Printed by WALTER KING (at the Office of King, Sell, and Railton, Ltd., 12, Gough Square); and published by him at 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, Oct. 24, 1893.